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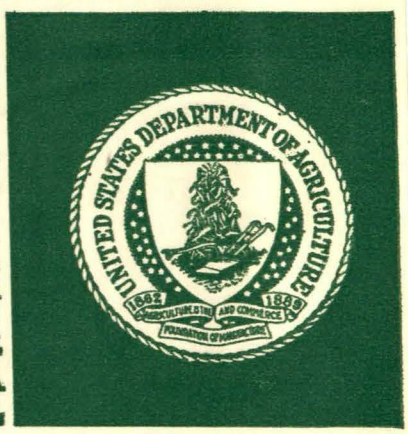

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1971 at the Northeastern Station

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
WARREN T. DOOLITTLE, DIRECTOR
1972

FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE, UPPER DARBY, PA.

1971 at the Northeastern Station

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NORTHEASTERN FOREST EXPERIMENT STATION
WARREN T. DOOLITTLE, DIRECTOR • 1972

1971 : GENERAL

1971 HAS BEEN marked by increased emphasis on the implications of man's activities on the forest environment. At the Northeastern Station, this emphasis is reflected in revised programs aimed at greater interdisciplinary research and by the establishment of a new research unit for environmental research, at Pennington, New Jersey.

The purpose of this Annual Report is to review briefly with you changes in programs and people and highlights of current activities and accomplishments during the year. In the back of the report there is a bibliography, which lists the publications by Station members and cooperators for 1971. Most of the accomplishments in the next section of this report are keyed to a reference in the bibliography to assist readers who may wish to delve deeper into a subject.

Personnel

John H. Ohman succeeded Warren T. Doolittle as Assistant Director of Watershed, Engineering, Recreation, and Wildlife Habitat. Ohman came to Upper Darby from the Forest Service Branch of Forest Disease Research in Washington, D. C.

Daniel M. Schmitt became Assistant Director of Timber Management Research, succeeding Benjamin A. Roach. Schmitt came to us from the Southern Station's Genetics Laboratory at Gulfport, Mississippi. Roach served briefly in the Forest Service Timber Management Research Division in Washington, D.C.; then recently, he joined the staff of our silviculture research project at Warren, Pennsylvania.

Elwood L. Shafer, Jr., is Assistant Director of the new Pinchot Institute of Environmental Forestry Research. Shafer came to Upper Darby from Syracuse, N.Y., where he had been Project Leader for the recreation research unit.

Robert G. Rippey replaced Dean S. Foote in the Personnel Section—as Foote moved up to head the section. Rippey had been Administrative Assistant at the Insect and Disease Laboratory at Hamden, Connecticut.

Barbara E. Katz joined the Publications staff as an editor. Ross A. Writer left the editorial staff for a position in I&E with Region 5 of the Forest Service.

Denver P. Burns transferred from the Insect and Disease Laboratory at Delaware, Ohio, to the staff of the Assistant Director for Insect and Disease Research in Upper Darby. Barton M. Blum left the Timber Management Research Division in Upper Darby and joined the silviculture research unit at Orono, Maine.

Clifford Werner, Jr., joined Budget and Fiscal Section in Upper Darby; he replaced Raymond F. Lubelczyk who transferred to the Huron-Manistee National Forest at Cadillac, Michigan. Werner came to us from the Regional Office of Region 9.

Silas Little became Project Leader of the new environmental research unit at Pennington, New Jersey. Little transferred from a timber management research unit in Upper Darby. Robert O. Brush joined the environmental research unit at Amherst, Massachusetts. Brush was previously a landscape architect for a private concern in Springfield, Massachusetts. Barry D. Gordon also joined the Amherst unit; he is a geographer recently out of Syracuse University.

Dale S. Solomon transferred from the hardwood silviculture unit at Durham, New Hampshire, to the softwood silviculture unit at Orono, Maine. Arnold

Krochmal left the Berea, Kentucky, medicinal plants unit; he is now with the Southeastern Station at Research Triangle Park, North Carolina. Calvin C. Reeves, Jr., left the watershed unit at Durham to join the U.S. Navy.

Albert G. Snow, Jr., retired from the Project Leader position for the maple sap production unit at Burlington, Vermont; and Harry W. Yawney moved over within the unit to take Snow's place. George H. Moeller moved over within the recreation unit at Syracuse, New York, to become Project Leader behind Dick Shafer.

Luther R. Auchmoody transferred from the silviculture unit at Parsons, West Virginia, to a silviculture unit at Warren, Pennsylvania. David VanLear left the surface mine reclamation research unit at Berea, Kentucky; he is now with Clemson University at Clemson, South Carolina. James L. Bean joined the gypsy moth project at Hamden, Connecticut; Bean came to us from State and Private Forestry in Upper Darby. Hollis R. Large joined the Princeton, West Virginia unit on secondary marketing research. Large came to us from the University of Tennessee. Philip A. Araman completed his active military duty and rejoined our hardwood improvement unit in Princeton, West Virginia.

The Station gained two new administrative assistants at field locations during the year. Perry C. Johnson is the new Administrative Assistant at Hamden, Connecticut. He took Rippey's place. Johnson came to us from the Siuslaw National Forest. Walter P. Ballard, II, became Administrative Assistant at Durham, New Hampshire, when Earl Grant transferred to the Intermountain Station. Ballard came to us from the Plumas National Forest.

Information Services

The branch continued its efforts to relate the Station's research to the general public. In 1971, they issued eight photo stories and three brochures; and they handled requests for over 60,000 popular and technical publications. The branch also arranged and handled television and radio appearances for Station personnel and assisted in the publicity for the Recreation Symposium held at Syracuse, New York.

Personnel of the unit arranged and supervised a 1-day bus trip for minority high school students to the Pinchot Estate in Milford, Pennsylvania. Many of the students involved received their first exposure to the natural environment outside the city area.

Research Publications

Our Publications Branch continued its efforts to reduce the time required for editorial processing. Several changes in organization and procedures have taken place. However, the program hit a serious snag due to the transfer of Ross Writer to R-5. On top of this loss, there was the price-and-wage freeze, which blocked the recruitment of a replacement editor.

Despite the handicaps during the past year, the Station published 263 publications of various kinds—our all time high. Of these, 130 were printed by the Station, and 133 were published in scientific, professional, and trade journals. A list of them is included at the end of this report.

Management Analysis

This unit automated several of the administrative functions of the Station. Our salary and Fiscal Encumbrance systems were completed this year. These systems permit quicker and more accurate efforts in the financial management area and result in saving many man-hours of manual work.

Biometrics

Stan Arner returned to the Biometrics Branch after completing 2 years at Pennsylvania State University, where he studied statistics and computer science. He has developed a computer program for selecting independent variables in multivariate multiple regression.

Budget & Fiscal

The first grant under the authority of the Station Director was awarded in February 1971 to the Research Foundation of the State University of New York. Prior to that date, all grants had been awarded from Washington, D.C. Since February, five other grants have been awarded—one to Yale University, one to Penn State University, one to University of Connecticut, and two additional grants to the Research Foundation of the State University of New York College of Forestry at Syracuse, New York. Total value of the six grants is $112,287. Five of the six grants were awarded under the Pinchot Institute for Environmental Forestry Research.

Engineering

Funds were received for the construction of new research laboratories at Durham, New Hampshire, and Burlington, Vermont. Construction is expected to start in the first half of 1972.

RESEARCH ACCOMPLISHMENTS

Symposiums

In August 1971, the Northeastern Forest Experiment Station sponsored an "Oak Symposium" in cooperation with Northeastern Area State and Private Forestry, West Virginia University, the Appalachian Hardwood Manufacturers, and the West Virginia Department of Natural Resources. The purpose of this Symposium was to summarize knowledge and to point out gaps in our knowledge about the silviculture, management, and utilization of upland oaks. More than 300 people from 27 states and 4 foreign countries heard papers that dealt with such varied subjects as ecology, soil-site relationships, wildlife and oak management, various phases of silviculture and utilization, and insect and disease problems. The Station published the proceedings, consisting of 25 papers, prior to the Symposium.

Proceedings of the August 1970 symposium on "Trees and Forests in an Urbanizing Environment" were published in 1971 by the University of Massachusetts Cooperative Extension Service. The Symposium was planned and presented by the Northeastern Station and the University of Massachusetts.

A "Forest Recreation Symposium" was planned and presented at Syracuse, New York, this year by the USDA Forest Service and the State University of New York College of Forestry. Symposium papers brought together a wide range of recreational research studies in concise, understandable language so as to be of maximum benefit to recreation planners and managers in both the public and private areas of the forest recreation community. The complete set of papers was published by the Station in *Recreation Symposium Proceedings*. The five major subject areas included in the Proceedings are: planning and developing the recreation resource; managing the recreation resource; characterizing the recreation user; specific managerial considerations related to user characteristics; and a look at the research task ahead *(NEFES 1971)*.[1]

In cooperation with State and Private Forestry, we held a 2-day workshop in October at our Princeton Marketing Laboratory. The workshop dealt with the SHOLO (SHOrt LOg) mill concept. About 40 representatives from state and federal agencies and pallet industry firms attended. They received training in the methods used to determine under what circumstances it would be profitable to convert low-grade hardwoods into pallets, pallet parts, and pulp chips, using the SHOLO mill design and production technology. Nomogram charts were used for determining the various values needed for decision making *(Reynolds and Gatchell 1971)*.

The Pinchot Institute, in cooperation with the Pennsylvania State University and the Environmental Protection Agency, is planning a symposium on recycling of waste water in forests and open lands, to be held on August 21-24, 1972 at Pennsylvania State University. Topics of the Symposium will include problems and opportunities for recycling waste water in forests, effects of recycling waste water on forest ecosystems, health aspects, legal constraints, economic considerations, and examples of the practical applications of present knowledge on the subject. Additional future symposia on man-resource relationships within megalopolis are being considered and planned within the Institute.

We are assisting the Northeastern Forest Soils Conference in planning a regional "Symposium on Forest Fertilization." Co-sponsored by the Station, the Northeastern Area, State and Private Forestry, and the Canadian Forestry Service, the meeting will be hosted by the New York State University College of Forestry at Syracuse at its Warrensburg Campus north of Albany. The symposium, intended for eastern Canadian and U.S. foresters, is set for August 22-25, 1972. About 25 papers will be presented, covering all aspects of fertilization in forest ecosystems with emphasis on environmental, biological, and economic considerations.

Trees are Individuals

Individual trees of the same species can differ in their response to some treatments. When a Northeastern Station scientist tried to root softwood cuttings from three mature sugar maples, using several types and concentrations of growth regulators in trying to stimulate rooting, rooting response varied greatly *(Donnelly 1971)*.

Cuttings from one tree rooted well without auxins,

[1]For references cited, see list of publications at end.

and any additional auxins retarded rooting. Cuttings from a second tree rooted well without auxins, but a low level of additional auxins increased the rooting—while high levels inhibited rooting. Cuttings from the third tree rooted poorly without additional auxins although high levels reduced rooting over that obtained by low levels. The response to applied auxins varied inversely with the natural auxin content of the trees, which probably accounted for their individuality.

Good Sources of White Pine for Christmas Trees

White pine is a favored species for Christmas trees in some areas, but the suitability of the species for this use varies greatly. Needle color ranges from blue-green to yellow-green. Some trees retain needles from both the current year and the previous year through the winter; other trees have needles only from the current year. Some sources of white pine have needles 56 to 79 percent longer than those of other sources. And, of course, some sources have faster growing trees.

All these differences were considered in evaluating white pines for Christmas-tree production in eastern Kentucky and Ohio *(Walters 1971)*. White pines from Tennessee, North Carolina, Georgia, and lower Michigan were the best ones to use there as Christmas trees—far better than those from Maine, Iowa, Minnesota, or Quebec.

Converting Poor Oak Sites to White Pine

On poor oak sites, where trees are expected to be 45 to 60 feet tall at 50 years, white pines outgrow oaks, often reaching heights 10 feet taller in that period and producing more than 4 times the merchantable volume. Therefore, over a period of several years, we tested methods of esablishing white pine on poor oak sites in West Virginia *(Wendel 1971)*.

Although direct-seeding in cut and uncut stands and planting with immediate release were tried, underplanting 100 to 400 seedlings per acre and letting them grow for 5 to 10 years before removing the overstory was found to be the most efficient method. Mortality of the white pines was 35 percent through the overstory-removal period. Consequently, the number of white pines planted should depend on how complete a conversion is desired. Assistance in conducting the study was provided by the staff of the Monongahela National Forest.

Some Hardwood Culls Should not be Treated

Cull trees in hardwood stands, unless desired for wildlife, are frequently treated in stand-improvement operations because they take up growing space. However, not all cull trees need be treated to eliminate them from the stand—some will fade away without treatment. In a West Virginia study made by G. R. Trimble, Jr., and reported in *The Northern Logger and Timber Processor,* this class of trees was composed of stems of poor vigor—ones having a small live crown and many dead, dying, or sickly branches. In a 7½-year period, 57 percent of the poor-vigor cull trees died without treatment. Except for beech, all overtopped cull trees of good or medium vigor can also be ignored in TSI operations because over 80 percent remain or become non-competitive.

Measuring the Sweetness of Sugar Maple Sap

Sugar refractometers can be used to measure the sweetness of sugar maple sap at the taphole, in collection tanks, or at the sugarhouse. A refractometer can also be used in selecting sweet trees to include in sugarbushes. These conclusions were reached in a study of the consistency of refractometer sugar readings as influenced by sap evaporation, temperature, and the drying, cleaning, and calibration of the instrument. Procedures to insure reliable measurements are described by Smith and Keiser *(1971)*.

Should Sugar Maple Sap be Collected in the Fall?

In certain localities, some producers of maple syrup have collected enough sap to make tapping profitable in November and December; but our tests of fall tapping in northern Vermont show that the operation is not advisable there. Fall tapping should be restricted to areas where alternate periods of freezing and thawing occur during November and December—conditions apparently suitable for sap flows.

However, in 1968, such periods rarely occurred in our study area; and in 1969, they occurred even less frequently because hardly any thawing occurred after the first freeze. Vacuum pumping greatly increased collected sap-volumes over gravity yield, but still did not produce enough for a profitable operation. And sap sweetness was markedly lower than that from the same trees in the spring. Hence, producers of maple sap should exercise caution in starting fall operations. Detailed advice is given by Smith and Snow *(1971)*.

The Gypsy Moth's Path of Destruction

evere defoliation damage is evidence of gypsy moth feeding.

The gypsy moth larva eats up all tree foliage and green vegetation in its path.

Computer Technology Gets a Head Start on the Gypsy Moth

While the gypsy moth is making its long-distance drive through 10 states, computer technology is putting in its bid to overtake the insect pest; and it looks like it might outflank it.

In 1971, Forest Service researchers at Hamden, Connecticut, launched an accelerated gypsy moth research program to develop integrated control. This means that they will take all types of control measures and all aspects of the environment into consideration in order to achieve maximum results in managing the pest population while minimizing the impact of the control technique on the rest of the environment.

Among the most likely control techniques under study is the enhancement of insect mortality produced by agents already interacting with gypsy moth populations. To use this technique, we must learn what the important mortality-causing agents are and what underlying environmental conditions determine their effectiveness *(Campbell 1971)*.

Disease represents an important complex of mortality factors in the population dynamics of gypsy moth. The impact of some components of disease on natural populations of gypsy moth was determined by autopsy of diseased larvae in sparse and dense populations. Variation in the disease complex indicates that minor causes of disease in one population may well be the major causes in other populations.

There is, for example, significantly higher incidence of parasitoid involvement, but virtually no polyhedral virus, in relatively stable, sparse populations. Nuclear polyhedrosis virus probably is the primary mortality factor in dense populations. Many insects examined from sparse and dense populations showed no infectious agent or overt cause of disease, which may indicate a major regulatory role of noninfectious disease in natural populations.

Further study of the complete spectrum of disease

agents over a number of years of gypsy moth populations will be necessary to obtain better understanding of the disease complex *(Campbell and Podgwaite 1971)*.

In other research, 17 uniformly prepared *Bacillus thuringiensis* strains, representing nine serotypes, were bioassayed against larvae of a single gypsy moth population. Significant differences were observed between highly virulent and lowly virulent strains. Moreover, two of the strains showed uniform virulence against larvae from four different sources *(Dubois and Squires 1971)*.

Emphasis on the identification and development of microbial agents to control gypsy moth will continue in 1972.

Effects of Defoliation

Our understanding of the biochemical changes in sugar maple following defoliation by the gypsy moth and other insects has helped us to learn why some defoliated trees die. Defoliation causes significant reductions in overall root food reserves and changes in the relative amounts of different components of the food reserves. For example, the amount of starch declines and the amount of certain sugars, especially glucose and fructose, increases. These changes encourage the growth of the fungus *Armillaria mellea,* an important killer of trees. Trees stressed by defoliation are often attacked afterwards by this organism *(Houston, Parker, and Wargo 1971)*.

Discoloration and Decay

What do we really know about tree wound dressings? Most publications on the subject evaluate new materials on the basis of external, visual inspection. Tree dissection now indicates that the value of wound dressings is doubtful. They are not really satisfying their major objective: to prevent decay. New and better ways to treat wounds to prevent decay are being sought *(Houston, Shigo, and Wilson 1971)*.

For the first time, an anaerobic bacteria, *Clostridium* sp., has been recorded as being present in a living tree. In the past, fungi received most attention in the processes that result in discoloration and decay. Little is known about the species of bacteria involved or their concentrations in woody tissues. Now extremely high concentrations of bacteria have been shown to exist in certain discolored tissues associated with wounds in living, suppressed red oak, chestnut oak, and white oak *(Shigo et al. 1971)*.

Boring and Scale Insects

Buyers of white oak cooperage logs face disappointment and financial loss because they cannot determine insect damage within the log by looking at the surface. Our research on this problem has resulted in identification of the complex of wood boring insects responsible for the damage. We also found that stavemill operators are losing 3 to 13 percent of the staves in logs to the wood borers. Illustrations of the damage to white oak by six species of insects are now available in published form *(Burns 1971)*.

We have finally been able to quantify a case of serious impact on trees by a sucking insect. Tuliptree scale, an insect not much larger than a pinhead, has been proven to be capable of killing yellow-poplars. Over a 5-year period, over half of the yellow-poplars on a 10-acre site in Pennsylvania were killed or damaged. So much sap is sucked out of the trees by large numbers of the scale that the trees lose vigor and are crowded out, deformed, or killed outright *(Donley 1971)*.

Possible Life-Saving Shots for Trees

The advantages of controlling tree diseases by injecting fungicides directly into the sap stream of trees have long been recognized. Such applications can be more effective with smaller quantities of pesticide than spray or soil treatments, treatment schedules can be followed regardless of wind and rain, and placement and subsequent movement of the chemical is highly controlled.

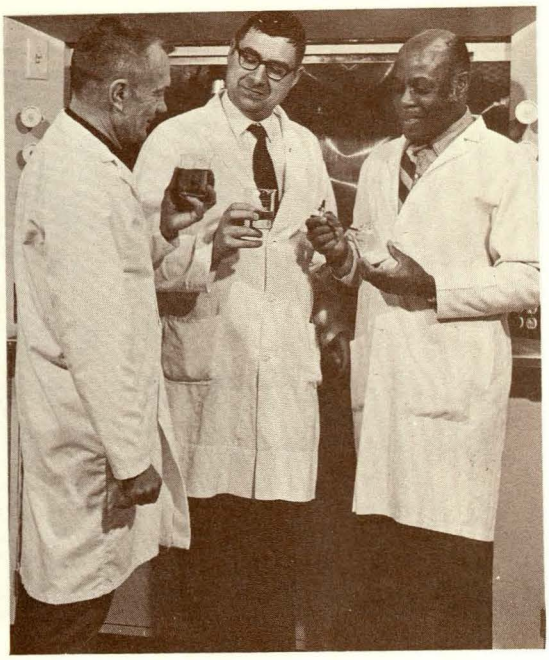
Thus, treatment by injection is not only economically advantageous for urban trees, but also avoids the environmental pollution hazards of other methods. Progress in this approach to disease control, however, has been limited by lack of suitable chemicals and an efficient means for their application.

But three Forest Service researchers—Thomas Jones, Garold Gregory, and Percy McWain—have now developed an apparatus for injecting solutions under pressure directly into the vascular system of trees. A unique feature of the system is that solutions are injected into the outermost sapwood, which facilitates rapid uptake and distribution. Injection of some hardwood species during the growing season results in immediate distribution of the injected solution throughout the tree in current sapwood, leaves, and at least some roots.

Distribution occurs following dormant-season treatment, but at a slower rate. The apparatus should per-

The whole injection unit, showing connection on tree, tubing, solution reservoir, and compressed gas.

New Injection– New Benomyl Solution– New Hope



The team of Forest Service scientists who made benomyl soluble and who developed a new tree injection that could prevent several tree diseases are (l. to r.) Thomas W. Jones, Garold F. Gregory, and Percy McWain.

mit rapid injection of certain fungicides, insecticides, herbicides, and perhaps hormones and nutrients into trees. Thus far, we have used it to inject the fungicide benomyl into elms, oaks, and maples *(Jones and Gregory 1971)*.

Benomyl, a recently developed fungicide, is effective against a variety of plant pathogens, including the fungi that cause oak wilt, Dutch elm disease, and Verticillium wilt in trees. In its manufactured form, it is nearly insoluble in water and not suitable for tree injection. However, we have succeeded in solubilizing this chemical. The solutions retain fungitoxicity and can be readily injected into trees.

Relatively large quantities of these solutions have been injected into oaks, elms, and to a lesser extent maples, even during the dormant season; and the fungitoxicant can be detected in the crowns of treated trees within 1 to 3 weeks. This offers the possibility of protecting trees from many fungus-caused diseases. Therapy for diseased trees may also be possible, particularly with diseases that do not envelop the entire tree immediately, such as Dutch elm disease and oak wilt in white oaks *(Gregory, Jones, and McWain 1971; McWain and Gregory 1971)*.

Much more research is needed before the apparent potential of this technique for control of tree diseases can be realized. Inoculation studies must be completed to fully evaluate prophylactic and therapeutic properties of solubilized benomyl; possible phytotoxicity problems must be recognized and minimized; and optimal dosages, volumes, concentrations, and treatment schedules must be determined. We believe that these problems can be resolved and that their solution will permit a major advance in our ability to cope with diseases of trees.

The Outdoor Spirit

DICK SMITH

Most campers say that camping is essentially a wilderness experience.

however . . .

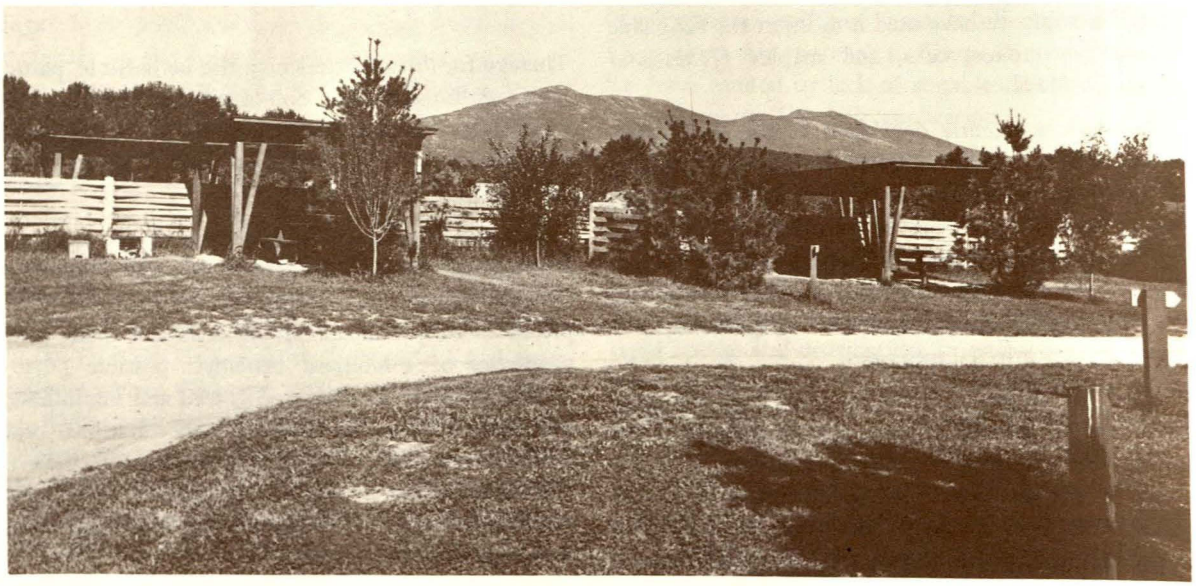
News for Campers

Supplying campers with the things they want is big business. And, if the increasing numbers of campers are to be satisfied, maintaining a healthy private campground industry and promoting its sound growth is essential because public campgrounds cannot come close to meeting the need.

Our recreation research units at Durham, New Hampshire, and Syracuse, New York, and a number of cooperators are developing market information for this purpose. One fruitful approach has been to periodically contact a panel of 565 campers over a period of 5 years to determine trends in their participation. This study seriously challenges the planners' common assumption that increasing per-capita participation is a prime cause of rising demand.

Another study predicted that the total number of campgrounds in the Northeast will increase in the years ahead but at a slower rate than in the Sixties. A study made in New Hampshire uncovered a serious problem: while there was a large increase in the number of campgrounds, 44 of the 108 private campgrounds in operation in 1964 went out of business before 1971. Several reports have been published to make this and other information available to those who need it *(LaPage and Fisher 1971; LaPage and Ragain 1971; Moeller 1971; and Whittaker and Echelberger 1971).*

Many campers prefer well-landscaped, private sites.



A New Research Mission

Planning was completed this year for our first formal multiproject program of research. Designated NE-MPP-1, Environment Systems—Central Appalachians, the program will involve coordinated research by 13 scientists in 5 separate research work units in timber, watershed, and wildlife habitat management, forest recreation, and forest engineering. The mission of the program is to develop well integrated information and techniques necessary for managing the soil, water, vegetation, wildlife, and recreation resources of the Central Appalachian region to maintain or improve the total forest environment while providing the yield of needed products. The program is designed to tie together past research in a single unified package for land managers and to undertake new research in problem areas where knowledge gaps exist.

Forest-Environment Interactions

Concern for ecological systems is greatly affecting decision making by forest managers charged with protecting and enhancing these lands so that they can provide the wide variety of products and services needed by an ever-increasing population. To help meet these obligations, research is providing a better appreciation and fuller understanding of the relationships between forest vegetation and the physical and biological environment.

Scientists at our research unit at Syracuse and at the State University of New York College of Forestry are cooperating to meet this challenge by making detailed multidisciplinary investigations at the Field Environmental Laboratory in the Charles Lathrop Pack Forest in the southeastern portion of the Adirondack Mountain region of New York State. This outdoor Laboratory includes plantations of several tree species that have received an array of fertilizer and irrigation treatments.

A series of investigations of the complex interactions among physical environmental factors of the atmosphere and of soil and their relationships to the total biota are under way. Included are studies of longwave and shortwave radiation, atmospheric moisture and temperature, soil moisture and temperature, nutrient element status and cycling, soil microorganism populations, and forest biomass distribution, including roots and above-ground vegetation. Particular emphasis has been placed on analytical techniques, especially temporal and spatial variation considerations. This work is developing concepts and principles as well as techniques that have applicability to many different ecosystems. *(Leaf, Leonard, and Berglund 1971; Leonard et al. 1971; Leaf, Leonard, et al. 1971).*

The Pinchot Institute

At the outset of the environment-conscious Seventies, the Forest Service established a special research institute to deal with forest related environmental concerns of megalopolis, the urbanized Northeastern seaboard of the United States. The Institute is named the Pinchot Institute for Environmental Forestry Research in honor of Gifford Pinchot, first Chief of the USDA Forest Service and one of America's foremost early conservationists *(Shafer and Doolittle 1971).*

Within the framework of the Pinchot Institute, the Forest Service has joined with nine Northeastern university and research institutions to form a Consortium for environmental forestry studies. The Consortium is gathering the information and developing the technology needed to solve problems of policy formulation, regional planning, and land management related to environmental forestry in and around Northeastern population centers.

One-half of the funds designated by the Forest Service for the Pinchot Institute are to be used for in-house research located at Amherst, Massachusetts, and Pennington, New Jersey; the other half of the Institute's funds are to be allocated as grants to participating Consortium members. The Forest Service in-house research and research of the other Consortium members is coordinated to meet the Institute's overall objective of determining how trees and forests can best serve the needs of megalopolis.

The Challenge of Man and His Environment

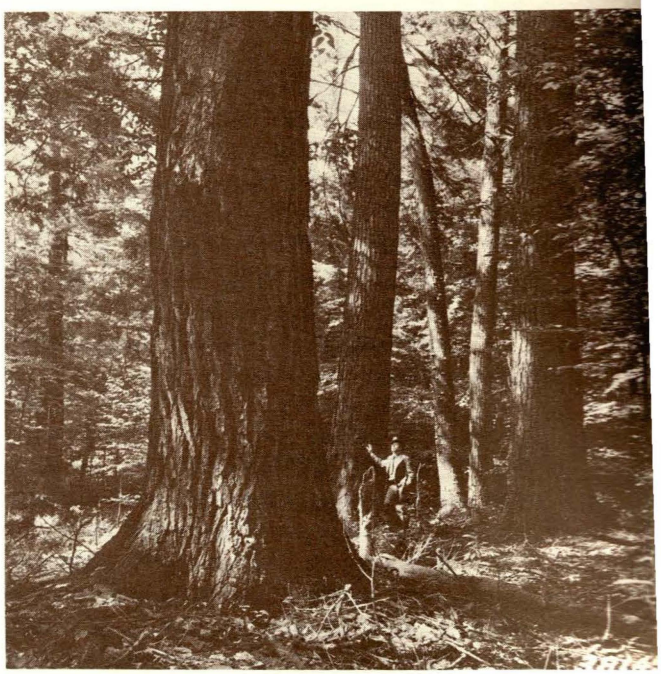
The Visual Landscape— A New Dimension in Research

An example of research planning among university and Forest Service scientists within the scope of the Pinchot Institute is typified in a recent publication about improving the human environment with vegetation in the urban-forest interface of the Northeast *(Zube, Davis and Brush 1971)*. Landscape architects, because of their skills—described by the authors as that of "integration through design"—can make significant contributions to research in environmental forestry.

The problem analysis deals with the visual landscape—the world we see. This represents a complex series of research questions. As a visual phenomenon, the landscape lends meaning to man through the interaction of its natural and man-made dimensions.

These landscape dimensions are changing because of economic, political, cultural, and ecological forces. The critical issue for this problem analysis is the visual consequences of these changes and, more specifically the relationship of the public landscape and of forest vegetation to these changes. Implicit is an interdisciplinary research approach.

The aesthetic or amenity emphasis is central to landscape architecture. It encompasses the interaction of the social and ecological or natural and man-made dimensions in man's comprehension of his environment. This aesthetic emphasis adds a difficult and challenging but essential dimension to the proposed research program.



Determining urban man's needs for trees and forest environments presents a significant research challenge.

Research is aimed at increasing amenities provided by natural vegetation in and around urban settings.

Research is under way to try to obtain quality water and recreation on watersheds. This bridle trail leads away from the reservoir proper.

A New Research Unit Is Established

The Northeastern megalopolis contains one of the world's largest and most dynamic industrial complexes, and the financial and political concentration of power in this region is second to no other area on Earth. The building of new homes, highways, and industries daily changes the environment. The power of man and his technology in this urbanized coastal corridor gives one a reason to pause and reflect on what is happening to the values or uses of the land resources. What about the aesthetics, amenities, and water?

Located in the very hub of the industrialized Northeast, the Station's newest Pinchot Institute in-house research unit at Pennington, New Jersey, is providing planning information on how trees and forests reduce noise and air temperatures. In addition, the unit's research is finding ways to obtain quality water and recreation from municipal watersheds.

The physical and biological science research aspects of the Pennington Unit complement the socio-economic and urban wildlife-habitat research already under way at the Pinchot Institute's other in-house research unit at Amherst, Massachusetts.

Headquarters of the new Pennington unit, shared with the Stony Brook-Millstone Watershed Association.

Reducing Noise in the Megalopolis

There are many reasons for establishing and maintaining trees in the environment of the megalopolis. One of these is to reduce noise pollution. Our researchers have made a modest start in identifying problems and potentials of the use of trees for noise abatement and have begun studies on the subject. Trees will not control or eliminate noise; but in many situations, they may reduce it enough to make the difference between a livable environment and one that is extremely unpleasant.

Studies to date indicate that forest stands can absorb about 6 to 8 decibels per 100 feet (sound in excess of about 125 decibels is considered unbearable). Noise reduction by trees is affected by stand density and configuration, weather, topography, and other factors. These will be studied in order to provide urban planners with usable information on how to realize maximum benefits from trees in the megalopolis *(Leonard and Herrington 1971, and Leonard 1971)*.

Wooden Guardrail Post Performance

Wooden highway guardrail posts can be easily machine-driven without any damage to the tops of the posts. But what happens to these posts when they hit rocks below the surface? In a comparison of wooden and steel posts on three rock-filled sites, we found that wood is superior to steel in resisting damage below the ground line.

The superiority of wood is due partially to its great strength in compression parallel to the grain and to the interaction between the post and the soil during driving. Wooden posts should have blunt bottoms because as they are driven, a cone of compressed top-layer soil material forms at the base of the post. This cone acts as a wedge, which reduces the energy required to drive and protects the bottom of the post from damage *(Gatchell and Lucas 1971)*.

Wood Helps Make Space-Age Metals

Increasing amounts of formerly wasted wood residues are being used as reducing agents in electric smelting for ferroalloys and silicon metal. These metals are used in alloy steel, aluminum engine blocks, transistors, solar batteries, and in metallo-organic substances such as polishing waxes, hand lotion, and even bouncing putty.

Although many types of wood and bark residues are now used, most users prefer large wood chips, referred to as "met chips" in the industry. Some met chips are made from roundwood and logging residues.

In 1970, consumption of wood in this market in the United States was 796,000 tons (green weight). Fifty-nine percent was consumed in the Ohio and Tennessee River valleys. Wood volume used in this manner is expected to continue increasing in the future *(Wartluft 1971)*.

Pulpwood Production in the Northeast Expected to Show Outstanding Growth

The annual pulpwood production surveys conducted by the Station provide the basis for a review of the past trends and projected future growth of the pulpwood and woodpulp industries in the Northeast. Considering current trends, we expect pulpwood production to reach 15 million cords by 1985. Present production is 6.6 million cords.

This study reveals that the region is likely to become even more dependent upon hardwood species. Also, plant residues as a source of pulpable wood are expected to be less important in the future because lumber production, the primary source of chipped plant residues, is not expected to keep pace with the growth of the pulpwood industry. The recycling of waste paper is expected to increase, but not to play a major role in the Northeast in the next 10 years. The primary reason for this is that serious economic obstacles to collecting, sorting, and transporting of repulpable waste must be overcome before recycled material can compete with virgin fibers.

With a relatively abundant and lightly tapped hardwood resource, the southwestern portion of the region (Kentucky, West Virginia, and Pennsylvania) is expected to show the greatest increase in pulpwood production *(Kingsley 1971)*.

Hardwood Tree Grades and Lumber Yields

Hardwood trees have for many years been measured in such a way that tree volume could be estimated; and in recent years the prediction of tree quality by using tree grades has become of interest to owners, sellers, and buyers of timber. Several tree-grading systems have been developed, but none has been used on a widespread scale. The Forest Service

recently adopted and approved a set of interim hardwood tree grades for factory lumber. The specifications for these tree grades and the associated lumber grades volumes for yellow birch, red maple, and black oak are presented in a Station publication *(Hanks 1971)* released this year.

Defining Subareas for Regional Analysis

One task facing investigators of regional activity is the selection of appropriate subregions for analysis. Most analysts accept existing areas such as political subdivisions or, at best use subjective methods to divide a region into subunits. We developed and demonstrated an objective procedure for choosing subregions that are problem oriented: "A Technique for Defining Subareas for Regional Analysis", published in *Growth and Change.* The methodology was used to select five homogeneous and compact areas that are meaningful for studies of the economic efficiency of Pennsylvania's pulpwood industry. Anyone having access to a high speed computer can make use of the technique.

Working Tools for Computer-Based Research

The benefits of using computer technology in forestry are manifold. But the technique is still new to many people, and its possibilities are not fully understood.

Station researchers concerned with marketing timber and roundwood products have developed several sets of working tools so that computer technology will be useful to more people. These tools consist of user's manuals and program source decks. A prospective user need not agonize over the time and procedures required to apply a complicated-looking computer program. He merely consults the manual, combines his input data with the source deck, and runs the program at an available computer facility. For one of our programs, he can even request the services of trained experts to help organize the working tool for his particular operation.

The preparation of these working tools has benefited the public by quickly and inexpensively transmitting complicated research solutions into practical answers to its problems. We have used both direct and indirect approaches to give our customers the kind of service they need.

The direct approach consists of reproducing a user's manual and source deck for a flexible and universally applicable MULGRES program for multiple regression analysis *(Martin 1971).* The indirect approach embodies the cooperation of State and Private Forestry personnel in conveying, interpreting, and applying the source deck to operations of interested sawmill operators.

The novelty of this research accomplishment lies in our "second mile" efforts to make detailed research procedures easily available. From the hundreds of requests received from national and international sources, our efforts have obviously been successful.

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PUBLICATIONS

in 1971 by staff members and cooperators of the Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.

GENERAL

Frayer, Warren E., R. W. Wilson, and G. M. Furnival.

1971. **FSCREEN (fast screen), a computer program for screening all combinations of independent variables in univariate multiple linear regressions.** 23 p. Colo. State Univ. Dep. Forest and Wood Sci. Fort Collins, Colo.

The computer program described here calculates coefficients of determination for all possible combinations of independent variables in a univariate multiple linear regression. Up to 20 independent variables can be used. Examples of control deck setups and program outputs are given.

Furnival, G. M., and R. W. Wilson, Jr.

1971. **Systems of equations for predicting forest growth and yield.** Statist. Ecol. 3: 43-55. Pa. State Univ. Press.

This paper outlines a method of treating a growth and yield model as a system of equations with simultaneous estimation of all the coefficients in the system. The techniques are well known and widely used in econometrics, but have never, so far as we know, been applied to mensurational problems.

*Larson, Edwin vH.

1971. **A guide for authors of symposium papers.** USDA Forest Serv. Res. Note NE-144. 7 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Suggestions for preparing a symposium paper for publication, including general style, manuscript format, and handling of tables, illustrations, footnotes, literature references, etc. Also suggestions for typing.

*Publications with asterisks (*) are available for distribution upon request.

Larson, Edwin vH.

1971. **An editors' notebook for authors.** NE. Forest Exp. Sta., Upper Darby, Pa.

An in-service training guide for writers, consisting of brief notes about word usage, sentence structure, punctuation, and other aspects of writing. Examples taken from Station manuscripts were used to identify faults, explain the language principle involved, and demonstrate a correction.

Little, Silas.

1971. **Protect homes from forest fires.** Rutgers Univ. Coll. Agr. and Environ. Sci. Coop. Ext. Serv. Ext. Bull. 401. 8 p.

A guide that outlines the ways in which planning boards, town officials, builders, and homeowners can help protect buildings from forest fires.

*Marx, Hal.

1971. **X-rays for trees.** Forest Farmer 31 (1): 9, 18, illus.

A mobile field x-ray unit developed for use on trees holds promise of helping tree pathologists and entomologists diagnose the extent of decay and defect in a tree.

*Northeastern Forest Experiment Station.

1971. **Trees need your help, too.** USDA Forest Serv. NE. Forest Exp. Sta., 8 pp., illus. Upper Darby, Pa.

A foldout brochure describing people pressure diseases (PPD) that affect trees, including air pollution and the damage done in construction operations. Some recommendations for caring for and protecting trees, based on research in forest pathology.

Northeastern Forest Experiment Station.

1971. **Trees need your help, too.** Outdoor Oklahoma June 1971: 14-15.

See above.

*Northeastern Forest Experiment Station.
1971. **The Mead Corporation experimental forests: Vinton Furnace and Mead.** USDA Forest Serv. NE. Forest Exp. Sta., 12 pp. Upper Darby, Pa.

A fold-out brochure describing these two experimental forests in Ohio and the research now being carried out there to develop ways for putting upland oak sites into full production by finding the best techniques for establishing natural oak stands, the intensive culture needed for growing high-quality trees and stands, and guidelines for different sites, products, and management objectives.

*Northeastern Forest Experiment Station.
1971. **1970 at the Northeastern Station.** USDA Forest Serv. NE. Forest Exp. Sta., 54 pp. Upper Darby, Pa.

A report on the Station's activities and accomplishments in 1970, plus an annotated list of publications during the year.

*U. S. Forest Service.
1971. **Forests for the future.** (Revised 1971.) NE. Forest Exp. Sta. and E. Region, Milwaukee, Wis. 8 pp., illus.

A brochure explaining clearcutting and even-aged management as a scientific method for harvesting and regenerating light-demanding hardwoods, based on research by the Northeastern and Central States Forest Experiment Stations.

TIMBER MANAGEMENT

Auchmoody, L. R., and H. Clay Smith.
1971. **Four year effects of fertilization and lime on mineral composition of sugar maple foliage.** Agron. Abstr. 116.

A single broadcast application of 22.4 metric tons/ha. of hydrated lime with and without varying rates of water-soluble fertilizer containing N, P, K, Mg, and Zn was made in a 75-year-old sugar maple stand in Vermont. Concentration changes of foliar N, P, K, Ca, Mg, Mn, Zn, Cu, and Fe, monitored annually for 4 years, were used to assess the effectiveness and longevity of nutrient treatments. The timing in changes of foliar concentration after treatments varied considerably for the individual elements.

*Bjorkbom, John C.
1971. **Production & germination of paper birch seed and its dispersal into a forest opening.** USDA Forest Serv. Res. Pap. NE-209. 14 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A 3-year study of paper birch seed crops and seed dispersal showed that seed quality is important in evaluating a seed crop. Good seed represented 53 to 86 percent of the total seed production, and this seed had the better germination. Most of the seed was dispersed in October and November. Germinative capacity and germinative energy were also greatest in these months. More than three times as much seed fell in the forest as in an adjoining clearcutting, and the amount of seed decreased rapidly as distance from the forest edge increased.

*Blum, Barton M.
1971. **Some correlations between sugar maple tree characteristics and sap and sugar yields.** USDA Forest Serv. Res. Note NE-143, 4 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Simple correlation coefficients between various characteristics of sugar maple trees and sap sugar concentration, sap volume yield, and total sugar production are given for the 1968 sap season. Correlation coefficients in general indicated that individual tree characteristics that express tree and crown size are significantly related to sap volume yield and total sugar production. However, there was little evidence of a strong relationship between such tree characteristics and sap sugar concentration. Correlations presented were for one sap season only.

*Carl, Clayton M., Jr., and Albert G. Snow, Jr.
1971. **Maturation of sugar maple seed.** USDA Forest Serv. Res. Pap. NE-217. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Germination of sugar maple seeds collected weekly from August to October indicated that when the

majority of samaras have turned yellowish green, or the moisture content has dropped below 145 percent, germination of at least 95 percent can be expected. The time of seed maturation may differ between trees by as much as 3 weeks.

*Carmean, Willard H.
1971. **Soil-site relationships of the upland oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 23-29, illus. Upper Darby, Pa.

Site quality for upland oaks can be estimated directly by using site-index curves, or indirect estimations can be made by using soil-site prediction methods. Presently available harmonized site-index curves may not be suitable for all upland oak species, or may not be suitable throughout their range. New stem-analysis data show that different species of oak have different patterns of height growth; for older ages these patterns are markedly different from patterns predicted by harmonized site-index curves. Soil-site studies for upland oaks are reviewed, and suggestions are made for coordinating these results with soil surveys for forested lands.

*Carvell, Kenneth L.
1971. **Silvicultural aspects of intermediate cuttings.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 60-64, illus. Upper Darby, Pa.

Correct timing of the first thinning in mixed oak stands depends largely on the composition and condition of the stands and on available markets for small wood products. Delaying first thinnings in high-quality seedling-origin stands until a long, straight, clear bole has developed is of primary importance in assuring high quality of the final crop trees. However, many of our present stands, particularly those of sprout origin, need improvement work; and improvement cuttings or thinnings should be started as soon as a commercial operation is possible.

*Cech, Franklin C.
1971. **Tree improvement research in oak species.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 55-59. Upper Darby, Pa.

Early efforts at developing new forms of oak by interspecific hybridization have not been very successful, although spontaneous hybrids appear rather readily in nature. Preliminary reports on a few seed-source or provenance studies indicate that differences among sources are generally less than differences among trees within sources. This directs tree-improvement programs along the line of single-tree selection. Selection methods followed in several programs are briefly outlined, and it is suggested that breeding programs to develop oak-wilt-resistant individuals be started immediately.

*Clark, F. Bryan, and Richard F. Watt.
1971. **Silvicultural methods for regenerating oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 37-43, illus. Upper Darby, Pa.

Advance reproduction is the key to forming the new oak stand. However, the size or strength of advance stems is just as important as number. Most oak stands approaching maturity have enough advance reproduction, but many do not. In such cases, harvest cuttings must be delayed and overstory densities regulated to favor the establishment and development of new oaks in the understory.

*Core, Earl L.
1971. **Silvical characteristics of the five upland oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 19-22. Upper Darby, Pa.

The five most important upland oaks of eastern North America are white oak (*Quercus alba*), chestnut oak (*Q. prinus*), northern red oak (*Q. rubra*), black oak (*Q. velutina*), and scarlet oak (*Q. coccinea*). Of these, white oak and northern red oak are most characteristic of northern aspects, coves, and lower slopes, while chestnut oak, black oak, and scarlet oak are typically found on upper slopes and dry ridges.

Czapowskyj, Miroslaw M.
1971. **Book review of "Forest fertilization — Waldduengung."** Soil Sci. 3:271.

The book is a result of the Colloquium on Forest Fertilization held in Finland in 1967. It contains 39 papers. The European experiences may be of great benefit to those interested in forest fertilization in the United States.

Doolittle, Warren T.
1971. **Tree improvement and environmental forestry.** NE. Forest Tree Impr. Conf. Proc. 18: 65-69.

A discussion of how tree improvement can help on forest environment. Careful selection breeding and testing of trees may result in a significant reduction of air pollution and noise.

*Donnelly, John R.

1971. **Individual tree differences confound effects of growth regulators in rooting sugar maple softwood cuttings.** USDA Forest Serv. Res. Note NE-129. 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Softwood stem cuttings from three mature sugar maple trees were treated with several types and concentrations of growth regulators. Lack of statistical significance was due to extreme variability in tree response: low levels of auxin stimulated rooting in two study trees, while auxins inhibited rooting in the other tree. It is postulated that variations in rooting response may have been caused by corresponding differences in endogenous levels of naturally occurring auxins.

*Dorrell, Frederick A.

1971. **Multiple-use management of upland hardwood forests.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 159-161. Upper Darby, Pa.

In recent years the National Forests have experienced much controversy over multiple-use management. Because of this, the Forest Service is examining ways to improve the multiple-use planning process. One of the new approaches involves a special plan for eight National Forests in the south and central Appalachian Mountains, in which planning is done by interdisciplinary teams, and the public is significantly involved in the planning process.

*Filip, Stanley M.

1971. **An example of product yields from an even-aged northern hardwood stand in New Hampshire.** N. Logger 19(12): 22-23, illus.

A clearcutting in a 90-year-old even-aged northern hardwood stand yielded a variety of products having a delivered value of $758 per acre. A nearby uneven-aged (old-growth) stand yielded products valued at only $688 per acre. This helps to demonstrate that even-aged stands containing high-quality paper birch in mixture with species mostly of low quality on poor vigor may peak in product value when the short-lived paper birch becomes mature.

*Filip, Stanley M., and Elbert L. Little, Jr.

1971. **Trees and shrubs of the Bartlett Experimental Forest, Carroll County, New Hampshire.** USDA Forest Serv. Res. Pap. NE-211. 20 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The native woody species on the Bartlett Experimental Forest include 33 trees and 32 shrubs. An annotated list with scientific and common names is presented to provide a record of the woody vegetation of the area.

*Gatchell, Charles J.

1971. **Black cherry.** USDA Forest Serv. Amer. Woods Ser. FS-229, 8 pp., illus.

Black cherry grows in significant commercial quantities only in the northern Allegheny Mountains. This publication discusses its distribution, growth, supply, production, properties, and principal uses.

*Gingrich, Samuel F.

1971. **Management of young and intermediate stands of upland hardwoods.** USDA Forest Serv. Res. Pap. NE-195. 26 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Growth and yield comparisons were made for a 10-year thinning interval when thinnings are begun at different points in the life of even-aged upland hardwood stands. Silviculture recommendations are based on the physical yields from four options: leave the stand alone, start thinning, regenerate and leave the stand alone, and regenerate and thin. Thinnings that are begun at an early stand age produce a substantial yield increase over stands that are first thinned after age 50.

Gingrich, Samuel F.

1971. **Management of young and intermediate stands of upland hardwoods.** Southern Appalachian Hardwoods Symp. Proc. 1970: 70-97. Asheville, N. C.

Same as above.

*Gingrich, Samuel F.

1971. **Stocking, growth, and yield of oak stands.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 65-73, illus. Upper Darby, Pa.

An appraisal of stocking in even-aged upland oak stands is a prerequisite for determining the cultural needs of a given stand. Most oak stands have sufficient stocking to utilize the site, but are deficient in high-quality trees. Thinning such stands offers a good opportunity to upgrade the relative quality of the growing stock and enhance the growth and yield potential. The physical yields of timber products from thinning are greatest when thinning is begun at an early age. Thinnings should be made from below at 10- to 15-year intervals.

Graber, Raymond E.

1971. **Frost heaving as a cause of eastern pine seedling mortality.** Tree Planters' Notes 22(4): 24-28.

Frost heaving caused serious losses in this study of direct seeded white pine seedlings. Seedlings were most frequently killed when they were physically lifted by frost heaving. Less commonly, mortality occurred when a seedling was broken or girdled by frost action. Shading both during the growing season and during the dormant season significantly reduce losses due to frost heaving. Retaining some portion of the natural plant cover on areas to be direct seeded to provide shade and reduce frost heaving is recommended.

Hoyle, M. C.

1971. **Effects of the chemical environment on yellow birch root development and top growth.** Plant and Soil 35: 623-633.

Yellow birch develops a very shallow root system in New England podzol soils, which no doubt restricts growth and development. Split medium cultures showed that a lower substrate that was deficient in Ca and high in Al restricted root and top growth even though the upper substrate was nutrient-adequate. Fertilization practices should include specific provisions for correcting subsoil deficiencies and toxicities.

*Hungund, Basalingappa L., and Chandravadan H. Pathak.

1971. **A survey of plants in Gujarat, India, for alkaloids, saponins, and tannins.** USDA Forest Serv. Res. Pap. NE-201. 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Of 105 plants collected and tested, 86 were found to be alkaloid-bearing, 34 were found to contain saponins, and 44 were found to contain tannins.

Huntzinger, Harold J.

1971. **Long-term storage of black cherry seed.** Tree Planters' Notes 22(4): 3-4.

We studied the germination of black cherry seed stored for 1 to 3 years in several types of containers under various temperature and seed moisture conditions. Almost none of the seed stored at room temperature or in the freezer at 12 to 15 percent moisture content remained viable for even 1 year. High viability was retained even after three years by seed stored in the freezer at 4 to 6 percent moisture content or in the refrigerator at both moisture contents.

Krochmal, Arnold, and Juanita Huguely.

1971. **Seed descriptions of four common Lobelias.** Castanea 36: 257-259, illus.

Botanical descriptions, with illustrations, of the seeds of *Lobelia inflata* L., *L. cardinalis* L., *L. puberila* Michx., and *L. siphilitica* L.

*Krochmal, Arnold, and Karyl Magee.

1971. **A population of *Lobelia inflata* L.** Castanea 36(1): 71-76, illus.

An analysis of soils in a fallow field rich in *Lobelia inflata* L., and a list of associated species.

Leak, William B.

1971. **Simulation of forest succession.** Summer Computer Simulation Conf. 1971: 820-825, illus.

Forest communities are dynamic populations subject to birth, death, growth, and migration processes — the same moving forces that affect the development of animal or human populations. Birth-death patterns of forest species are related to their aggressiveness and shade tolerance. Two simulation models were used to predict successional change in northern hardwood forests. One model utilizes constant birth and death rates; the other, rates related to population density. Simulated changes reflect species characteristics and initial population density.

*Northeastern Forest Experiment Station.

1971. **Oak symposium proceedings.** USDA Forest Serv. NE. Forest Exp. Sta., 161 pp., illus. Upper Darby, Pa.

A collection of 25 papers about the oaks, presented at a symposium held in August 1971 at Morgantown, West Virginia. Individual papers are listed separately.

*Olson, David F. Jr., and Stephen G. Boyce.

1971. **Factors affecting acorn production and germination and early growth of seedlings and seedling sprouts.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 44-48. Upper Darby, Pa.

Acorn production is extremely variable and unpredictable. Flowering is copious, but many climatic factors influence acorn development from initiation of flowers to acorn maturity. Acorns are consumed by birds, animals, insects, and microorganisms. The establishment of seedlings is more closely related to favorable site factors than to size of crops. A majority of oaks originate from advance reproduction that accumulates under the previous stands during several decades.

Rushmore, Francis M.

1971. **Effects of Accothion on birds (intensive studies on sapsuckers).** *In* **Environmental studies of Accothion for spruce budworm control:** 88-100.

Free-flying sapsuckers were used to monitor the effects of Accothion on bird mortality and behavior. Observations of 74 birds were made, before and after spraying, at 9 nesting territories in the sprayed area and at 4 in the unsprayed area. Sapsucker nestlings were banded and placed in nest-blocks, where normal nesting activities continued. Nestlings fledged and lived normally in their home territories. The spray apparently did not cause sapsucker mortality. Some mortality occurred but was probably caused by nest disturbance and predators.

*Russell, T. E.

1971. **Seeding and planting upland oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 49-54. Upper Darby, Pa.

Upland oaks can be established by seeding or planting, but additional experience is needed before these methods become economical alternatives to natural regeneration. Recently forested sites are generally more favorable than abandoned fields. Lack of repellents to protect acorns from animals severely limits direct-seeding, but oaks can be planted readily by conventional methods and will survive well on suitable sites. They require ample sunlight for best growth, and competing vegetation must be controlled.

*Sander, Ivan L.

1971. **Height growth of new oak sprouts depends on size of advance reproduction.** J. Forest. 69: 809-811, illus.

The early height growth of new oak sprouts present after clearcutting in southeastern Ohio depends upon the size of the old advance reproduction from which they originate. Sprouts from the largest stems of advance reproduction grew the fastest, but these large stems also produced the most sprouts. Stems less than 0.5 inch in diameter at the ground line produced the most single sprouts, but these sprouts did not grow fast enough to keep pace with the rest of the stand.

Sander, Ivan L., and F. Bryan Clark.

1971. **Reproduction of upland hardwood forests in the central states.** U. S. Dep. Agr. Handbk. 405: 25 pp., illus.

Data from studies of reproduction after various harvest-cutting methods had been applied to upland hardwood stands. Regardless of how the stands were cut, natural hardwood reproduction was always adequate to produce acceptable new stands; but the heavier the cutting, the more stems there were of intolerant species, and the faster they grew. Of all cutting methods, clearcutting consistently promoted the largest amount of reproduction of intolerant species, the most rapid growth of the new stand, and the best quality stems.

Schreiner, Ernst J.

1971. **Genetics of eastern cottonwood.** USDA Forest Serv. Res. Pap. WO-11. 19 p.

A contribution to the genetics series on important forest trees of North America. The potential for improvement through selection and various breeding methods is discussed. The use of multiclonal mixtures to achieve specific products goals and to minimize pest-susceptibility is advocated.

Schreiner, Ernst J.

1971. **Application of tree improvement to mini-midi- and maxi-rotation management.** NE. Forest Tree Impr. Conf. Proc. 18 (1970): 39-48, illus.

The use of several silvicultural systems to produce specific products on specific sites is discussed. Genetically improved planting stock and short rotations are recommended for fiber products on high potential sites. Natural regeneration and longer rotations will continue to be used on areas (infertile, steep, or remote sites) where genetic improvement conversion is not economically feasible.

*Smith, H. Clay.

1971. **Tapping near old tapholes in sugar maple trees.** USDA Forest Serv. Res. Note NE-126. 3 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of sugar maple tapping indicated that sugar producers can drill a new taphole within 1 inch of an old taphole in a horizontal direction and obtain normal sap and sap-sugar yields.

*Smith, H. Clay.

1971. **Sap volume flow as influenced by tubing diameter and slope percent.** USDA Forest Serv. Res. Note NE-137. 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The amount of sugar maple sap that can move through plastic tubing is controlled by several

factors. The most important are tubing diameter and slope percent. Estimates are given of the number of tapholes that can be used with combinations of these variables.

*Smith, H. Clay, and Carter B. Gibbs.
1971. **How many trees?** Nat. Maple Syrup Dig. 10(2): 5-7.

A sugar maple stocking guide has been developed for the management of sugar bushes. This information is based on the relationship between crown diameter and diameter at breast height (d.b.h.) of open-grown trees. This published material presents the number of trees per acre and a spacing guide for using this per acre information in undeveloped forest stands. Additional information is published in a Research Paper NE-171.

*Smith, H. Clay, and Carter B. Gibbs.
1971. **Collecting maple sap with unvented spouts, using aerial and ground lines.** USDA Forest Serv. Res. Note NE-130. 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Two methods of using plastic tubing to collect sugar maple sap were tried: aerial lines and ground lines. Unvented spouts were used in both. Sap yields collected from the aerial and ground lines were not statistically different from each other.

*Smith, H. Clay, and George M. Keiser.
1971. **Testing sugar maple sap for sweetness with a refractometer.** USDA Forest Serv. Res. Note NE-138. 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on consistency of refractometer sugar readings as influenced by sap evaporation, temperature, and the drying, cleaning, and calibration of the instrument. From the study results, field procedures are suggested for using the refractometer to insure reliable measurements.

*Smith, H. Clay, and Richard J. Lamore.
1971. **Speed of tapping does not influence maple sap yields.** USDA Forest Serv. Res. Note NE-132. 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
Results of this study showed no statistical difference in the quantity or sweetness of sugar maple sap collected from tapholes that were drilled with a variety of tappers running at different drilling speeds.

*Smith, H. Clay, and Albert G. Snow, Jr.
1971. **Maple sugaring with vacuum pumping during the fall season.** USDA Forest Serv. Res. Note NE-134. 5 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Vacuum pumping of sugar maple trees during the late fall and early winter months is not advisable in northern Vermont. However, fall pumping may be profitable in other areas of the sugar maple range. It is recommended that the weather pattern in a given locale be observed; and if conditions are favorable, vacuum pumping should be tried on a small scale before attempting a larger operation.

*Thirgood, J. V.
1971. **The historical significance of oak.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 1-18. Upper Darby, Pa.

A brief history of the importance of oak in Europe, contrasting the methods used in France and Britain to propagate the species and manage the forests for continued productivity. The significance of oak as a strategic resource during the sailing-ship era is stressed, and mention is made of the early development of oak management in North America. The international trade in oak logs and lumber is also discussed.

*Trimble, George R., Jr.
1971. **Some hardwood culls do not need treatment . . . and these can be identified.** N. Logger 20(1): 12, 32, 33, illus.

A 7½-year study of hardwood-cull-tree vigor and mortality was made on the Fernow Experimental Forest in West Virginia, to determine what type of culls can be ignored in timber-stand-improvement operations. Some culls will either die soon or persist with such low vigor that they will be essentially noncompetitive.

*Trimble, George R., Jr.
1971. **Early crop-tree release in even-aged stands of Appalachian hardwoods.** USDA Forest Serv. Res. Pap. NE-203. 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A need exists for guidelines for crop-tree release operations in young even-aged hardwood stands. The author discusses the results to date of research in West Virginia with crop-tree selection and release. The methodology and the timing of this operation are discussed, and some data on costs are presented.

*Trimble, George R., Jr.

1971. **Diameter-limit cutting in Appalachian hardwoods: boon or bane?** USDA Forest Serv. Res. Pap. NE-208. 14 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

This paper deals with diameter-limit cutting in Appalachian hardwoods, summarizing the reports of past work and describing the results of 20 years of research in West Virginia. Diameter-limit cutting is compared to individual-tree selection cutting in terms of species composition, timber quality, and board-foot growth rate. The aim of this paper is to provide a basis for judging the merits of this widespread cutting practice.

*Walters, Russell S.

1971. **White pine provenances for Christmas trees in Eastern Kentucky and Ohio.** USDA Forest Serv. Res. Pap. NE-185. 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Eastern white pine provenances from the Appalachian mountains in Tennessee, North Carolina, Georgia, and from lower Michigan appear to have the best potential for Christmas tree production in eastern Kentucky and Ohio. This was determined from observations of needle length, needle retention, needle color, and tree heights of 16 provenances in study plantations in eastern Kentucky and southeastern Ohio.

*Wendel, G. W.

1971. **Converting hardwoods on poor sites to white pine by planting and direct seeding.** USDA Forest Serv. Res. Pap. NE-188. 19 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Based on results of recent research and on published data, recommendations are presented for converting hardwoods growing on poor sites to white pine. It appears that underplanting of poor site hardwood stands, with subsequent harvesting of the overstory in 5 to 10 years, may be the most efficient artificial regeneration method.

Wilkinson, R. C., J. W. Hanover, J. W. Wright, and R. H. Flake.

1971. **Genetic variation in the monoterpene composition of white spruce (*Picea glauca* (Moench) Voss).** Forest Sci. 17(1): 83-90.

Monoterpene composition of cortical oleoresin samples was determined for 16 populations of white spruce growing in lower Michigan. A cluster analysis of the data suggests that white spruce consists of two distinct clines or gradients extending from the Lake States northwest to Alaska and northeast to Labrador.

FOREST ECONOMICS

*Barlow, Roger.
1971. **Oak management for wood products.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 152-158, illus. Upper Darby, Pa.

A method is presented for analyzing oak management alternatives through comparisons of the present value of the net cash flow produced. Even-aged management without age-class regulation returned $72.60 of present value over a 40-year period. In the next 40 years the only expenses reduce the present value to $72.43. To regulate this stand into a forest with an equal number of acres in each age class, the present value is estimated to be $71.08, for a regulation cost of $1.35 per-acre. The average acre, selectively cut to create an all-aged stand, returns a present value of $63.17.

*Bones, James T., and Teresa M. Bowers.
1971. **Wood residues — how much are we recovering?** N. Logger 20: 22, 23, 35, 47.

A substantial amount of Northeast's timber harvest is left in the woods during harvesting and is lost during primary manufacture. The authors present a comparison of these losses for three points in time and discuss why they occur, what changes have taken place, and what can be done to increase utilization in the future.

*Bones, James T., and David R. Dickson.
1971. **Pulpwood Production in the Northeast—1970.** USDA Forest Serv. Resource Bull. NE-24. 34 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

An annual report based upon canvasses of pulpwood production in the Northeast. It contains data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 8 years are shown for the Northeast.

*DeBald, Paul S., and Joseph J. Mendel.
1971. **Determining the rate of value increase for oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 142-151, illus. Upper Darby, Pa.

A method used to develop rate of value increase is described as an aid to management decision-making. Regional rates of value increase and financial maturity diameters for ten species common to the oak-hickory type are outlined, and the economic principles involved are explained to show how they apply to either individual trees or stands.

*Gansner, David A., Donald W. Seegrist, and Gerald S. Walton.
1971. **A technique for defining subareas for regional analysis.** Growth and Change 2(4): 20-24, illus.

Describes an objective method for dividing a region into meaningful subregions and demonstrates its application to a typical problem.

*Kingsley, Neal P.
1971. **Pulpwood in the Northeast: past, present, & future.** USDA Forest Serv. Resource Bull. NE-23. 21 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A look at the past and present of the pulpwood and woodpulp industries in the 14 Northeastern States provides the background for discussing the future of the pulpwood industry in the Northeast. A projection of pulpwood production to 1985 is presented. Also discussed are what forms of pulpwood will be produced, what sections of the region have the greatest potential for increases in pulpwood production, and what effect recent and future mill closings will have on future pulpwood production.

*Quigley, Kenneth L.
1971. **The supply and demand situation for oak timber.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 30-36, illus. Upper Darby, Pa.

Twenty oak species in the eastern United States account for one-third of the hardwood sawtimber volume and almost 10 percent of both hardwood and softwood growing-stock volume. The oak-hickory and oak-pine forest types occupy about 38 percent of the forest land in the eastern United States. Oak timber volume is increasing. Annual growth exceeds annual removals by about 20 percent. In the next 30 years large increases in demand for oak timber are probable; and the better quality oak timber, particularly in the South, will probably be increasingly scarce.

*Webster, Henry H., and John C. Meadows, Jr.
1971. **Economic evaluation of intermediate operations in oak stands.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 74-83. Upper Darby, Pa.

Economic evaluation of forest-management opportunities is a vital ingredient of effective forestry programs. Choices among management opportunities are necessary because opportunities inevitably exceed funds available, and they are important because opportunities commonly range from highly productive to decidedly unproductive. Economic evaluation in oak stands shows a wide range in productivity. Primary factors influencing this range include site-productivity, length of the investment period, and division of costs between private owners and public assistance.

*Worley, David P., and James H. Patric.
1971. **Economic evaluation of some watershed management alternatives on forest land in West Virginia.** Water Resources Res. 7: 812-818, illus.

Timber and water research conducted at the Fernow Experimental Forest provides a 10-year record of timber growth and streamflow increases. An approach for evaluating streamflow increases in terms of timber growth forgone is modeled. Light cutting (up to one-fourth of the timber volume) slightly increased the value of timber growth as well as the amount of streamflow. Average annual water costs ranged from 0 to $1.30 per thousand gallons. Although these water costs may be invalid outside the Fernow Experimental Forest, they nevertheless suggest a magnitude for water costs under similar forest conditions.

*Writer, Ross, and R. B. Redett.
1971. **The forest heritage of Ohio.** USDA Forest Serv. NE. Forest Exp. Sta., 24 pp., illus. Upper Darby, Pa.

A brochure describing the forest resources of Ohio, based on data from the 1966-67 forest survey of the State. Almost one-fourth of Ohio is now forested, an increase of 17 percent since 1952. The volume of timber has increased about one-third in the last 15 years.

FOREST PRODUCTS MARKETING AND UTILIZATION

*Adams, Edward L.
1971. **Effect of moisture loss on red oak sawlog weight.** USDA Forest Serv. Res. Note NE-133. 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study was made to determine the effect of moisture loss on the weights of red oak sawlogs. The logs, ranging from 9 to 21 inches in scaling diameter and from 8 to 14 feet in length, were dried for a 12-week period. The 21-log sample lost 7.6 percent of the total green sawlog weight. The weight loss for individual logs ranged from 5.3 to 14.5 percent. In general, as log size and weight increased, the percent of weight loss decreased.

Adams, Edward L.
1971. **Instructions for using the SOLVE use packet.** USDA Forest Serv. NE. Area State and Private Forest. 20 pp., Upper Darby, Pa.

Part of the SOLVE use packet, which also contains the SOLVE computer deck and a listing of the available data for the 10 hardwood species that are included, and instructions for setting up the SOLVE system for an individual sawmill. By following these instructions, a sawmill operator can determine how much he can afford to pay for hardwood sawlogs delivered to his mill yard.

*Allison, Richard C.
1971. **Utilization of oak residues.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 111-117, illus. Upper Darby, Pa.

Residues should be thought of as a raw material for specific uses rather than as a waste. Fines and solid wood residues are usually kept separated in waste-collection systems, but species are rarely kept separated. The properties of each species dictate what uses can be made of them. Quantity, location, cost, moisture content, physical size, and presence of foreign matter should be known if the raw material is to be marketed for a specific

use. Each kind of residue has certain potentials for use. Case examples cited indicate how firms are marketing their residues.

*Anderson, R. Bruce.
1971. **Southern furniture manufacturers increasing in-plant production of dimension stock.** Woodworking & Furniture Dig. 73(3): 30-32, illus.

The results of a study based on a survey of furniture firms producing wooden furniture in the 16 states of the South Atlantic, East South Central, and West South Central regions as defined by the U. S. Department of Commerce. Present and potential markets for hardwood dimension parts used by the southern furniture manufacturers are discussed and structural conditions of the market, including product mix and size and location of firms, are examined.

*Baumgras, John E.
1971. **Configuration of Appalachian logging roads.** USDA Forest Serv. Res. Pap. NE-198. 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Road grade and curvature were measured on 206 miles of forest truck roads in southern Appalachia. 75 percent of the distance sampled was in grades below 8 percent and 80 percent of all curvature exceeded a radius of 300 feet. Logging-road configuration is not severe in Appalachia, so other factors of trucking efficiency in the log transport system should be evaluated.

Baumgras, John E.
1971. **Logging-machine recording instruments —a new management tool for loggers.** S. Lumberman 223(2776): 102-104, illus.

The author describes various types of recording instruments and shows how some can be applied to machines used in logging operations. Recorders used to monitor logging jobs can help the supervisor spot problems to correct them and prevent accidents, reduce machine wear, and boost production.

*Bennett, H. D.
1971. **Past, present, and potential products from oak.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 90-93. Upper Darby, Pa.

The warmth, beauty, character, and interest created by oak moved it into prominence in Gothic and Jacobean furniture and architecture, and in the woodwork of the baronial castles of England and the chateaux of France. Today oak has again found its rightful place in the furniture field, and over 30 percent of the production of upland oak finds a market in Spanish, English, French, and Early American design. Though furniture offers the major market, pallets, laminated trailer floors, railroad ties, and other industrial uses are all rising steadily. Flooring is still an important market for oak.

*Brisbin, R. L., and D. L. Sonderman.
1971. **Tree grades for eastern white pine.** USDA Forest Serv. Res. Pap. NE-214. 30 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The Forest Service standard sawtimber tree-grade specifications for eastern white pine. The tree-grade system is used for predicting the quantity and value of standard yard lumber that can be sawed from the various grades and sizes of white pine trees. The lumber-grade performance tables presented in this report are based on lumber-recovery studies made in New England, the southern Appalachians, and the Lake States.

*Church, Thomas W., Jr.
1971. **Technical considerations in harvesting and sawing defective hardwood butts.** USDA Forest Serv. Res. Pap. NE-189. 17 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Data from 219 sugar maple butt logs were analyzed to compare physical and economic differences between sound and defective logs. Unsound logs did not alter net truckload volumes significantly. Scaling precision was poorer for defective logs and could easily alter logging costs by $5 per MBF. Although net dollar yields were usually greater from sound logs, the inherent value of lumber sawed from defective logs was nearly identical.

Craft, E. Paul.
1971. **Construction grade plywood from grade 3 hardwoods — an industrial possibility.** Forest Prod. J. 21(2): 26-30, illus.

The feasibility of producing construction-grade plywood from grade-3 hardwood was determined by processing a sample of oak logs through an automated pine sheathing plant. Machinery and production processes used for pine plywood production were found to be readily adaptable to oak plywood production, and costs were competitive with pine production. Glue-bond-test results indicated a need for a more effective low-cost water-

proof adhesive and a need to develop standards that will apply directly to the glue-line quality required for construction-grade hardwood plywood.

Cuppett, Donald G., and E. Paul Craft.
1971. **Low-temperature drying of 4/4 Appalachian red oak.** Forest Prod. J. 21 (1): 34-38, illus.

Matched lots of green 4/4 red oak lumber were dried to 20 percent average moisture content in a low-temperature drier and in an adjacent air-drying yard. Low-temperature drying required 31 days for a 70°F. dry-bulb schedule, and 19 days for an 85°F. dry-bulb schedule. Air-drying required 61 days for lumber piled during June and July and 138 days for lumber piled in November and December. Degrade losses for low-temperature drying averaged less than one-half those for air-drying. Drying costs (including degrade) for the 85° F. low-temperature schedule were competitive with air-drying costs.

*Dunmire, Daniel E.
1971. **Predicting yields from Appalachian red oak logs and lumber.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 94-99. Upper Darby, Pa.

One utilization problem is in pinpointing how to efficiently and effectively recover usable parts from logs, bolts, and lumber. Yields, which are output divided by input, provide a key to managers who make processing decisions. Research results are applied to indicate yields of graded lumber and dimension stock from graded logs. How to calculate yields is shown. Managers may use these applications for developing processing alternatives.

*Emanuel, David M.
1971. **Power mulchers can apply hardwood bark mulch.** USDA Forest Serv. Res. Note NE-135. 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Two makes of power mulchers were evaluated for their ability to apply raw or processed hardwood bark mulch for revegetating disturbed soils. Tests were made to determine the uniformity of bark coverage and distance to which coverage was obtained. Moisture content and particle-size distribution of the barks used were also tested to determine whether or not these factors limited machine performance.

*Gammon, Glenn L.
1971. **Volume loss and grade change of hardwood lumber during air-drying.** USDA Forest Serv. Res. Pap. NE-227. 17 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Tabulated data are presented for 10 hardwood species, showing how green lumber changes in volume and grade when seasoned to the rough air-dried condition.

*Garrett, Lawrence D.
1971. **City fire codes become threat to natural Christmas tree sales.** Amer. Christmas Tree J. 15(3): 5-7, illus.

An analysis of city fire ordinances in 80 major U. S. cities revealed that; 3 cities would not permit the use of natural trees in public places under any circumstances; 61 cities required that natural trees be fireproofed before use; and of the 16 cities having no ordinances at present, 7 are planning to enact ordinances soon. Development of fire codes, the manner in which they are adopted, and the rigidness in which natural trees are defined as being inherently combustible materials are discussed.

*Gatchell, Charles J., and Edwin L. Lucas.
1971. **Machine driving of wooden and steel highway guardrail posts under adverse conditions.** USDA Forest Serv. Res. Pap. NE-212. 19 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Thirty-six wooden and 26 steel guardrail posts were machine-driven into a rock-filled base that was topped with limestone gravel and shale. Wooden posts were superior to steel in resisting damage below the groundline. Knots located between 3 and 12 inches from the base of flat-bottomed posts minimized damage. Flat-bottomed wooden posts tend to form a cone of compressed top-layer material, which protects the bottom of the post and reduces the energy required for machine-driving.

*Hanks, Leland F.
1971. **Interim hardwood tree grades for factory lumber.** USDA Forest Serv. Res. Pap. NE-199. 29 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Interim hardwood tree grades for standard lumber are presented along with dry lumber grade volumes for yellow birch, red maple, and black oak trees. For each species and tree grade, regression equations were derived that express volume by lumber grade as a function of d.b.h. and mer-

chantable height. By applying prices to the lumber grade volumes, a tree's value, in terms of lumber, may be estimated.

Hogan, William G., and Samuel M. Brock.
1971. **The effect of workmen's compensation on the logging and sawmilling industries in the Northeast.** W. Va. Univ. Off. Res. and Develop. Res. Ser. 17. 37 pp.

Several social and economic problems stem from the application of workmen's compensation to the logging and sawmilling industries in the Northeast. Most serious is the sigh cost. Federal safety standards could be established for logging and sawmilling, and this alone could give these industries an incentive to improve their safety records on a voluntary basis.

*Knutson, Robert G.
1971. **Getting a start on exporting.** N. Logger 19(8): 21, 36.

Wood-product firms often pass up opportunities to sell to foreign markets because they do not understand exporting procedures. By taking advantage of these markets they could increase their sales and at the same time help improve the balance of trade. Private and public agencies can assist the wood-product firms interested in exporting. Some of the services provided by the U. S. Department of Commerce are described.

Large, H. R., H. A. Core, G. R. Wells, and W. E. Duggans.
1971. **Hardwood flooring yields from Appalachian red oak lumber.** Univ. Tenn. Agr. Exp. Sta. Bull. 484. 20 p.

Grade and width of input lumber have a significant effect on the total yield by grade, and length of strip flooring. To tailor production to more closely match demand, the flooring manufacturer can vary the mix of his input lumber. In this way, the raw material will be used more efficiently, and the flooring manufacturer will improve his profit picture.

*Lewis, W. C., and B. G. Heebink.
1971. **Reconstituted products from oak.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 106-110, illus. Upper Darby, Pa.

"Reconstituted" describes a family of panel products made from fractionated oak, bonded with either a synthetic resin or a natural lignin bond. Several current commercial fiber panel products from oak are described, and the status of research on experimental products and processes is presented. Recent technological developments are removing the stigma associated with the use of oak as raw material for reconstituted panel products. It is probable that in the future reconstituted panels will be manufactured by a dry rather than a wet process.

Lohr, C. J., Bruce G. Hansen, and Jean W. Nolley.
1971. **Primary wood industries of Kentucky 1971: a utilization summary and directory.** Ky. Dep. Natur. Resources Div. Forest. 68 pp.

A summary of wood utilization in Kentucky, including data on employment, sawlog consumption, markets, and product specifications; and a directory giving the name, location, resource needs, production items, and daily capacity of primary wood-product industries.

*Martens, David G.
1971. Hardwood? Carpet? or Tile? USDA Forest Serv. Res. Pap. NE-200, 25 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A national study of comparative maintenance and long-term costs of residential flooring materials showed that hardwood flooring had the lowest annual maintenance cost and lowest long-term cost when compared with composition tile and carpeting used in living rooms, bedrooms, or dining rooms.

*Martin, A. Jeff.
1971. **The relative importance of factors that determine log-hauling costs.** USDA Forest Serv. Res. Pap. NE-197. 15 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of transportation costs for 34 logging operations in West Virginia showed that hauling costs were most sensitive to changes in the truck driver's hourly wage, followed closely by number of hours worked per day or year, purchase price of the vehicle, and tire costs. Sensitivity analysis was conducted on 41 factors, and the results were ranked.

*Martin, A. Jeff.
1971. **MULGRES: A computer program for stepwise multiple regression analysis.** USDA Forest Serv. Res. Note NE-128. 5 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

MULGRES is a computer program source deck that is designed for multiple-regression analysis

employing the technique of stepwise deletion in the search for most significant variables. The features of the program, along with inputs and outputs, are briefly described, with a note on machine compatibility.

*Miller, William C.
1971. **Physical distribution of oak strip flooring in 1969.** USDA Forest Serv. Res. Pap. NE-207. 31 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A survey of residential and commercial hardwood flooring manufacturers showed that oak strip flooring was produced predominately in the Southern and Appalachian hardwood regions, was distributed primarily by wholesalers and nonstocking wholesalers, and was consumed mainly in states east of the Mississippi River.

*Miller, William C.
1971. **Distribution of maple strip flooring in 1969.** USDA Forest Serv. Res. Pap. NE-215. 24 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A survey of residential and commercial hardwood flooring manufacturers showed that maple strip flooring was produced predominately in the northern Lake States region, distributed primarily by flooring subcontractors and wholesalers, shipped mainly into states east of the Mississippi River, and promoted through advertisements in trade publications.

*Moser, Harold C.
1971. **Manufacture of oak furniture, cabinets, and panels.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 100-102. Upper Darby, Pa.

Oak is uniquely favored for use in furniture, cabinets, and similar products. The supply is plentiful. Though drying presents some problems, once oak is properly dried it is a stable wood that machines very well, glues well, and accepts a variety of finishes well.

Murphey, W. K., B. E. Cutter, E. Wachsmuth, and C. Gatchell.
1971. **Feasibility studies on gluing of red oak at elevated moisture contents.** Forest Prod. J. 21(8): 56-59.

Report on a series of exploratory studies on parameters associated with gluing wood at a high moisture content. Green red oak was successfully glued with resorcinol by drying the surfaces with heated platens or air. Immediate closing of the assemblies and 24-hour clamp pressures are recommended. The urea, casein, and melamine adhesives used did not produce satisfactory bonds.

*Nolley, Jean.
1971. **Christmas tree marketing—a bibliography.** (1971 Supplement.) Amer. Christmas Tree J. 15(2): 25-29.

An annotated bibliography of recently published information from 105 major publications about the Christmas tree industry, production, management practices, silviculture, marketing, and consumption.

*Ostrander, M. D.
1971. **Identification & evaluation of defects in eastern white pine logs & trees.** USDA Forest Serv. Res. Pap. NE-190. 27 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The primary factors that influence the quality and value of eastern white pine logs and trees are described and illustrated as a guide for identifying and evaluating the grading and scaling defects to be considered in applying the standard eastern white pine log grades.

*Ostrander, Myron D., and Robert L. Brisbin.
1971. **Sawlog grades for eastern white pine.** USDA Forest Serv. Res. Pap. NE-205. 25 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

This report describes the standard sawlog grade specifications for eastern white pine as approved by the USDA Forest Service. The log-grading system is used for predicting the quantity and value of standard yard lumber that can be sawed from the various grades and diameters of logs. The specifications are also useful for determining proper bucking practice to provide the optimum yield in terms of standard yard lumber.

*Pendleton, Thomas H., and Lawrence D. Garrett.
1971. **Factors that influence Christmas tree sales.** Christmas Merchandiser: 12, 14.

An analysis of the metropolitan Christmas tree market in Winston-Salem, N. C., showed that, to sell more trees, Christmas tree retailers should locate their lots on heavily traveled streets in business areas, have adequate parking facilities, advertise, and have attractive displays of trees. Retailers who follow these practices can expect to receive higher prices for their trees. To insure that the market operates efficiently, Christmas tree retailers need information about effective marketing practices.

*Rast, Everette D.
1971. **Preliminary work in developing sawbolt grading systems for white oak.** USDA Forest Serv. Res. Pap. NE-193. 14 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

To achieve total tree utilization, boltwood must be considered as one of the prime products. At present there are no standard bolt grades. This publication describes a technique for developing sawbolt grades. A trial grading system was developed, using discrete rather than continuous grades.

*Reynolds, Hugh W.
1971. **Manufacture of industrial products from oak.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 103-105, Upper Darby, Pa.

The three largest and fastest growing markets for oak are railroad crossties, reusable pallets, and truck and container flooring. Manufacturers of oak lumber are advised to keep these products in mind when planning their production.

*Reynolds, Hugh W., and Charles J. Gatchell.
1971. **The SHOLO mill: return on investment versus mill design.** USDA Forest Serv. Res. Pap. NE-187. 46 pp., illus. NE Forest Exp. Sta., Upper Darby, Pa.

A technique is described for determining the return on investment in establishing a SHOLO (SHOrt LOg) mill for converting low-grade hardwood logs into pallet parts and pulp chips, as an aid to deciding whether a SHOLO mill is a worthwhile investment. Nomogram charts are used for determining the various values needed for decision-making. Returns of 14 to 22.5 percent are obtainable.

Wartluft, Jeffrey L.
1971. **Measuring bark residues from red oak saw logs.** S. Lumberman 223(2776): 167-168, illus.

Preliminary information from a study designed to give sawmill operators a means for estimating how much bark residue they generate. For estimating the weight of red oak bark residue for logs of different sizes, an alinement chart, based on log volume, was prepared.

*Wartluft, Jeffrey L.
1971. **The use and market for wood in the electrometallurgical industry.** USDA Forest Serv. Res. Pap. NE-191. 12 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The market is for large wood chips to be used as reducing agents in electric smelting. In 1970, United States consumption of wood in this market was 796,000 tons (green weight), 59 percent of which was consumed in the Ohio and Tennessee River valleys. Volume of wood used in this industry is expected to continue increasing in the future.

FOREST INSECTS

*Barger, J. H., R. A. Cuthbert, and N. H. Roberto.
1971. **Assessment of three pre-cold storage preparations on the feeding response of *Scolytus multistriatus* and the degradation of Dicrotophos.** J. Econ. Entomol. 64: 621-624, illus.

Twig crotches collected from American elm trees, *Ulmus americana* L., which had been treated with dicrotophos were either frozen in liquid nitrogen or dry ice, or left unfrozen before being stored at —10°C. for periods up to 6 months. Bioassays, using the smaller European elm bark beetle, *Scolytus multistriatus* (Marsham), caged on twig crotches, were conducted to ascertain effects of pre-cold storage preparations, cold storage dicrotophos degradation, and dose of dicrotophos.

*Barger, J. H., and W. K. Hock.
1971. **Distribution of Dutch elm disease and the smaller European elm bark beetle in the United States in 1970.** USDA Plants Dis. Rep. 55: 271-272.

Distribution of the smaller European elm bark beetle, *Scolytus multistriatus* (Marsham), and the Dutch elm disease in the United States is reported as of 1970.

*Buckner, C. H.
1971. **Vertebrate predators.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 21-31. NE. Forest Exp. Sta., Upper Darby, Pa.

Of the many vertebrates of the forest, only a few prey on forest insects—warblers, fringilids, and woodpeckers among the birds; and insectivores and rodents among the mammals. Behavioral characteristics increase the impact of vertebrates. When abundant, an insect species may become the sole dietary component. Examples from North America and Europe include spruce budworm, European pine sawfly, jackpine sawfly, and winter moth.

*Burns, Denver P.
1971. **Insects that hurt the bourbon stave industry.** Wooden Barrel 38(6): 6-9, illus.

Insects are an unpredictable source of damage in cooperage-quality white oak. Insect damage, measured at three Ohio mills, resulted in rejection of 1.3 to 11.4 percent of the staves cut. Edgings cut because of insect defect averaged an additional 1.7 percent. Damages caused by four species of grubs and two species of pinworms are described.

Burns, Denver P.
1971. **The gypsy moth research program.** Nat. Plant Board Annu. Meeting Minutes 45: 68-70.

The author discusses four major components of the Forest Service Research program on gypsy moth: (1) develop control techniques, (2) understand the factors that affect gypsy moths and their environment, (3) integrate understanding of the gypsy moth with newly developed controls, and (4) predict gypsy moth and host-tree populations with and without artificially introduced control agents.

*Burns, Denver P.
1971. **Yellow-poplar weevil.** USDA Forest Pest Leafl. 125, 5 pp., illus.

The yellow-poplar weevil, *Odontopus calceatus* (Say), has in recent years injured leaves and defoliated trees of the yellow-poplar, *Lirodendron tulipfera* L., one of the most important hardwoods in the Appalachian mountain region. The author discusses hosts, distribution, evidence of attack, life history, and natural control of the weevil.

*Burns, Denver P., and David E. Donley.
1971. **Quantitative field collection of honeydew.** Ann. Entomol. Soc. Amer. 64: 532-534, illus.

A report on a way to quantitatively collect honeydew in the field without contamination. A harness of plastic screen positions a glass vial under an individual scale. The shape and dimensions of the harness are described and several applications are discussed.

*Campbell, Robert W.
1971. **What's new in entomology and pathology.** Soc. Amer. Forest. Allegheny Sect. Winter Meeting Proc.: 1-3.

Current trends in forest-pest management are viewed as a return to earlier concepts, using the ongoing action-research program on gypsy moth as an example. Current uses of the electronic computer are stressed.

*Campbell, Robert W.
1971. **Introduction.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 1. NE. Forest Exp. Sta., Upper Darby, Pa.

The possible adverse side effects of pesticides have resulted in a tide of public concern in increasing constraints on their use. However, we have an increasingly urgent need to produce supplemental or alternative population-management systems.

*Campbell, R. W., and J. D. Podgwaite.
1971. **The disease complex of the gypsy moth. I. Major components.** J. Invertebrate Pathol. 18: 101-107.

Diseased larvae were examined from sparse and dense populations. Nuclear polyhedrosis was the primary mortality factor in the dense populations, while parasitoid incidence was significantly higher in the sparse populations. Many of the larvae examined contained neither infectious agents nor showed any overt cause of death. Thus noninfectious diseases may be a major regulator of natural populations.

*Collins, D. L.
1971. **Toward integrated control.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 2-6. NE. Forest Exp. Sta., Upper Darby, Pa.

Although the expression "integrated control" has caught on with the public, its ambiguity allows it to mean different things to different people. The author suggests that integrated control, in the last analysis, is only the weighting of the balance of nature in what we consider to be a favorable direction.

*Donley, David E.
1971. **Tuliptree scale damages Pennsylvania yellow poplar.** Pa. Forests 61(2): 40-41, illus.

The tuliptree scale (*Toumeyella liriodendri* Gmelin) can be a serious pest of yellow-poplar (*Liriodendron tulipifera* L.). In 5 years the scale damaged over half the yellow-poplar regeneration on a 10-acre field in southwestern Pennsylvania. A band of tanglefoot around the trunks of infested trees prevents ants from driving off natural parasites and predators of the scale. Trees thus protected showed scale population reduced by 50 percent.

*Donley, David E.
1971. **Track the hickory nut weevil.** Ohio Woodlands 9(4): 13, illus.

The adult female hickory nut weevil *Curculio caryae* (Horn) leaves characteristic markings on nuts containing her eggs. Identification of infested nuts is essential for controlling this pest of hickory seeds. A brief summary of the pest's life cycle is presented so that controls can be timed on the basis of insect "tracks."

Dubois, Normand R., and Alan H. Squires.
1971. **The determination of the relative virulence of *Bacillus thuringiensis* and related crystalliferous bacteria against gypsy moth larvae *Porthetria dispar* (L.)** Int. Colloq. Insect Pathol. Proc. 4: 196-208. Belgrade.

Seventeen uniformly prepared *B. thuringiensis* strains representing nine serotypes were bioassayed against larvae of a single gypsy moth population. Based on the response, the strains were divided into three groups; high, moderate, and low virulent. The difference was significant (P,05) between high virulent and low virulent strains but not between high and moderate virulent or moderate and low virulent groups of strains.

*Galford, Jimmy R.
1971. **Improved techniques for rearing the smaller European elm bark beetle on artificial media.** J. Econ. Entomol. 64: 1327-1328.

Ten generations of smaller European elm bark beetles were reared on two artificial media. One medium was used for oviposition and the other for rearing larvae. The beetle eggs were mechanically extracted from the ovipositional medium with a blendor; and when the eggs hatched, the larvae were hand-planted in the larval medium. There was no apparent change in behavior or physiology of the beetles after 10 generations of artificial rearing.

*Gibson, Lester P.
1971. **Insects of bur oak acorns.** Ann. Entomol. Soc. Amer. 64: 232-234.

During 1961-69, the insects found damaging acorns of bur oak, (*Quercus macrocarpa* Michx.) in their order of importance were the weevils *Curculio pardalis* (Chittenden), *C. strictus* (Casey), *C. Sulcatulus* (Casey), *C. iowensis* (Casey), *C. proboscideus* F., *C. confusor* (Hamilton), *Conotrachelus naso* LeConte, and *C. posticatus* Boheman; and the moth *Melissopus latiferreanus* (Walsingham).

Hastings, A. R., and P. A. Godwin.
1971. **White-pine weevil.** USDA Forest Pest Leafl. 21 (revised). 7 pp., illus.

Stages of the weevil and its life history are described. Evidence of infestation and resulting damage are pictured. Biological, mechanical, and chemical control methods are suggested.

Klawitter, Ralph A.
1971. **A new thrust against forest pests.** S. Lumberman 222(2756): 23-26, illus.

The Northeastern Forest Experiment Station is engaged in a new thrust to develop biological and other tools to combat tree pests. The thrust is directed towards gypsy moth, Dutch elm disease, air pollution, and other pest systems. An understanding of the biology of these pests is the key to ultimate control and management.

*Kleiner, Gail F., and John W. Peacock.
1971. **Amino acids in the haemolymph of smaller European elm bark beetle larvae, *Scolytus multistriatus* (Marsham) (Coleoptera: Scolytidae).** Ohio J. Sci. 71(1): 36-43.

Nineteen amino acids and two amides were detected in the haemolymph of last-instar *Scolytus multistriatus* larvae by thin-layer chromatography. Glycine, arginine, glutamine, lysine, ornithine, histidine, asparagine, glutamic acid, serine, proline, alanine, valine, isoleucine, and leucine were readily detected. Taurine, phenylalanine, tyrosine, α- and β-amino butyric acid, and aspartic acid were less readily detected on some chromatograms and at times were apparently absent in the haemolymph extract. Cysteine, cystine, and cysteic acid were not adequately separated by any of the methods tried, but their presence was confirmed through co-chromatography.

*Leonard, David E.
1971. **Population quality.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 7-20. NE. Forest Exp. Sta., Upper Darby, Pa.

In the gypsy moth, the occurrence of an additional larval molt is evidence of a response to a qualitative change. These extra-instar larvae have a prolonged rate of development during instar I and therefore have a higher probability of dispersal. Preventing such a qualitative change by maintaining populations at sparse levels may help prevent widespread epidemics.

Lewis, Franklin B.
1971. **Mass propagation of insect viruses with specific reference to forest insects.** Int. Colloq. Insect Pathol. Proc. 4: 320-326. Belgrade.

This article is concerned with the techniques of mass propagation of forest insect viruses, with specific reference to production in living hosts. Two different systems are discussed and techniques compared: mass propagation of the nucleopolyhedroses viruses of *Neodiprion sertifer* (Geoff.) and *Porthetria dispar* (L). The similarities and differences between the two techniques are discussed and some reference is given to the expense involved.

Mazzone, H. M.
1971. **Cultivation of gypsy moth hemocytes.** Current Topics in Microbiolog. and Immunol. 55: 196-200, illus.

Hemolymph of gypsy moth was obtained from late larval stages. Melanization occurring in mature hemolymph was prevented by inhibition of tyrosine oxidase with cysteine contained in the media. Cultures of hemocytes produced a single predominant growth pattern. The cells readily attached to the vessel surface and proliferated within 1 hour. Cell growth proceeded in the form of clusters, and redistribution of cells was warranted after 5 to 7 days.

Mazzone, H. M., J. P. Breillatt, and N. G. Anderson.
1971. **Zonal rotor purification and properties of a nuclear polyhedrosis virus of the European pine sawfly.** Int. Colloq. Insect Pathol. Proc. 4: 371-379. Belgrade.

The K zonal rotor was utilized to process large quantities of virus infective larval homogenate, resulting in high yields of purified polyhedra within a few hours. A description of the rotor and the density gradient procedures are presented. Analyses were made on polyhedra, polyhedral protein and free virus particles.

*Northeastern Forest Experiment Station.
1971. **Toward integrated control.** NE. Forest Insect Work Conf. Proc. 3. USDA Forest Serv. Res. Pap. NE-194. 129 pp., illus. Upper Darby, Pa.

Constraints on use of chemical pesticides have focused attention on the need for broad, flexible, integrated and ecologically acceptable programs of forest insect control. In eight papers presented at this workshop, the authors discuss the possibilities in use of vertebrate and invertebrate predators, pathogens, parasites, and insecticides.

Northeastern Forest Experiment Station.
1971. **Gypsy moth eats its way thru eleven states.** Trees Mag. 31: 79-81, illus.

Introduced accidentally in Massachusetts in the 1860's, the gypsy moth has spread through the New England and Middle Atlantic States and has been found as far south as Florida. Forest Service research aimed at finding a way to control this pest is reviewed.

Peacock, John W.
1971. **The present status of research and controls for Dutch elm disease.** Assoc. Phys. Plant Admin. East. Reg. Annu. Meeting 20: 28 pp., illus.

Dutch elm disease and its beetle vector, *Scolytus multistriatus,* are being studied by a team of research scientists at the Insect and Disease Research Laboratory in Delaware, Ohio. Forest Service entomologists are investigating new and improved methods for beetle control, including the use of beetle attractants and feeding deterrents, small parasitic wasps, chemical sterilizing agents, and safer insecticides. Agriculture Research Service scientists are studying genetic and chemical resistance of elms to Dutch elm disease, and systemic fungicides for disease control.

*Peacock, John W., A. Charles Lincoln, John B. Simeone, and Robert M. Silverstein.
1971. **Attraction of *Scolytus multistriatus* (Coleoptera: Scolytidae) to a virgin-female-produced pheromone in the field.** Ann. Entomol. Soc. Amer. 64: 1143-1149, illus.

Three field studies were conducted to ascertain if pheromones are responsible in part for the aggregating behavior of *Scolytus multistriatus* (Marsham). It is proposed that tunneling virgin-female beetles produce a pheromone because more in-flight beetles of both sexes were trapped at elm bolts infested with virgin females than at any other experimental treatment. Some beetles were also trapped at elm bolts infested with male beetles or with both males and females and at uninfested bolts, probably in response to host odors.

Podgwaite, John D., and Robert W. Campbell.
1971. **Disease in natural gypsy moth populations.** Int. Colloq. Insect Pathol. Proc. 4: 279-284. Belgrade.

Diseased larvae of the gypsy moth, *Porthetria dispar* (L.), from both sparse and dense populations were examined and categorized on the basis of mortality factors. A significantly higher incidence of parasitoids, few bacterial pathogens, and the virtual nonexistence of polyhedral viruses were noted in the relatively stable, sparse populations. Nuclear polyhedrosis probably represented the primary mortality factor in the dense role.

*Sailer, R. I.
1971. **Invertebrate predators.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 32-44. NE. Forest Exp. Sta., Upper Darby, Pa.

Predation is one of the most important factors in maintaining stability in an ecosystem. The value of predators is discussed, and three approaches to their use for pest control: introduction of predator species into unexploited niches, modification of environment to enhance underexploitation by predators already present, and the mass production and inundative release of predators.

*Stairs, Gordon R.
1971. **Pathogens.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 45-58. NE. Forest Exp. Sta., Upper Darby, Pa.

Problems associated with the use of pathogens are stressed, including information gaps such as determining the quantitative incidence of candidate pathogens in natural populations and determining the relative susceptibility of different populations. Viral latency and promising pathogen toxins are discussed.

*Staley, D. H., W. N. Cannon, Jr., and W. R. Holt.
1971. **A mathematical model of an insect population with overlapping generations where the females are polyandrous and the males are subject to auto-sterilization.** Ann. Entomol. Soc. Amer. 64: 325-330, illus.

A mathematical model is used to describe effects of autosterilizing males in an insect population having overlapping generations. A process that maintains a constant ratio of sterile to fertile males in the population is assumed. Input parameters include survival rate, number of eggs laid, ratio of sterile to fertile males, mating competitiveness of sterile versus fertile males, and fraction of eggs laid that are fertile.

*Stark, R. W.
1971. **Integrated control, pest management, or protective population management.** *In* **Toward integrated control** (NE. Forest Insect Work

Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 111-129. NE. Forest Exp. Sta., Upper Darby, Pa.

The most urgent task pest managers face is to refine and strengthen the decision-making process wherein all relevant aspects are considered before making the decision whether population regulation should be undertaken. Integrated control is then viewed as an approach utilizing all suitable techniques in the regulation of the pest populations.

*Talerico, Robert L.
1971. **Fall cankerworm egg-mass studies.** J. Econ. Entomol. 64 (3): 763-764, illus.

Report on a study of oviposition habits of the fall cankerworm, *Alsophila pometaria* (Harris), on oak group trees to determine host preference, site preference on a branch, and the number of eggs that constitute a mass.

*Turnock, W. J., and J. A. Muldrew.
1971. **Parasites.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Pap. NE-194: 59-87. NE. Forest Exp. Sta., Upper Darby, Pa.

Analysis is made of attempts to control four categories of forest insect pests in North America through the use and manipulation of parasites. Several recommendations regarding release techniques and population dynamics information are suggested to improve the success of parasite use.

*Williams, Carroll B., Jr., and Patrick J. Shea.
1971. **Insecticides.** *In* **Toward integrated control** (NE. Forest Insect Work Conf. Proc. 3). USDA Forest Serv. Res. Paper NE-194: 88-110. NE. Forest Exp. Sta., Upper Darby, Pa.

Some of the insect pest problems that develop as a consequence of relying solely on insecticides for protection of crops are described. Two main factors — the necessity for control and the value of the crop—have resulted in different insecticide use history for forest and agricultural crops and their concomitant pest and environmental contamination problems. Possibilities of using insecticides within the integrated control concept are examined.

*Wollerman, Edward H.
1971. **Boxelder bug.** USDA Forest Serv. Forest Pest Leafl. 95, 6 pp., illus. (Revised).

The boxelder bug prefers to feed on seeds of *Acer negundo*. When numerous, they may feed on fruit of orchard trees. The bugs invade warm buildings to hibernate in the fall or may seek entry during warm days of winter or spring. The bug is pictured and described, with information on life history and suggestions for control.

FOREST DISEASES

Berry, Frederick H.

1971. **Eight years' loss from *Fomes annosus* in thinned shortleaf pine plantations in Missouri.** USDA Plant Dis. Rep. 55: 1085-1087.

The spread of *Fomes annosus* root rot in thinned shortleaf pine plantations in Missouri was followed over an 8-year period on plots established in 1963. Mortality from the fungus has declined since 1965, particularly since 1968.

*Berry, Frederick H., and John A. Beaton.

1971. **Decay not serious in northern red oak.** USDA Forest Serv. Res. Note NE-125. 5 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of 114 northern red oak trees (*Quercus rubra*) indicated that decay is not serious during the time necessary to produce high-quality sawlogs and veneer logs. Two heart-rot fungi, *Poria oleraceae* and *P. cocos,* accounted for almost 25 percent of the total decay volume in the study trees. Basal fire wounds, dead branch stubs, and open branch-stub scars were the most important means of entry for decay fungi.

Dochinger, Leon S.

1971. **The symptoms of air pollution injuries to broad-leaved forest trees.** *In* **Methods for the identification and evaluation of air-pollutants injurious to forests.** IUFRO Congr. Sect. 24 (Working Group on Fume Damage 92: 7-32. Gainesville, Fla.

The most important tree pollutants are sulfur dioxide, fluoride, and ozone. Attempts to relate these to effects on hardwood trees are hampered by deficiencies in instrumentation and methods of atmospheric analyses, by inadequate knowledge about how various factors alter comparatively simple gaseous forms into phytotoxicants of indefinable composition, by inability to distinguish air-pollution symptomatology from that caused by other causal agents, and by insufficient information about changes and interactions with which air pollutants are influenced by the total environment.

Dochinger, Leon S., Alden M. Townsend, and Donald W. Seegrist.

1971. **Responses of hybrid poplar trees to sulfur dioxide fumigation.** (Abstr.) Air Pollution Control Assoc. Proc. 64: 71-101.

This study verified the presence of significant interclonal variation in the tolerance of hybrid poplar (*Populus deltoides* Bart. cv. *Angulata* x *P. trichocarpa* Torr. and Gray) to SO_2 fumigation. Rooted stem cuttings of four hybrid poplar clones were exposed to 5 ppm. SO_2 for 0, 3, 6, 9, or 12 hours in controlled environment chambers. All partial correlations between foliar injury and subsequent shoot growth were positive and significant.

Freeman, Wilfred L., Jr., Leon S. Dochinger, and Robert C. Doerner.

1971. **Forest Service research and action programs for abatement of air pollution.** S. Lumberman 223 (2776): 87-89, illus.

A cooperative team approach is being used by the USDA Forest Service, state, and private agencies in problems of air pollution to plants. Some examples are presented, including that of a lead smelter in Missouri that produced injurious gaseous oxides.

Fridrich, James H., Avery E. Rich, and Alex L. Shigo.

1971. **Fungi isolated from fruits and seeds of some northern hardwood trees.** Rhodora 73: 306-308.

A variety of fungi were isolated from the fruits and seeds of northern hardwood trees. Most of the fungi were Fungi Imperfecti and Ascomycetes.

*Gillespie, William H.

1971. **The oak wilt situation.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 124-128. Upper Darby, Pa.

Although oak wilt has been studied for more than 30 years, there are many facets of the disease that are little understood. Continuing federal-state cooperative studies are geared to predicting the overall effects of the disease on future forest-management programs, but much additional research is needed before present control programs can be expanded or discarded.

Gregory, G. F.

1971. **Transpiration of bur oaks during oak wilt pathogenesis.** (Abstr.) Phytopathology 61: 893. Transpiration (in a growth chamber) was determined for pairs of 2-year-old bur oak ramets after

inoculation of one member of each pair with *Ceratocystis fagacearum*. The other served as a control. All plants were weighed daily to determine transpiration loss.

*Gregory, Garold F.
1971. **Correlation of isolability of the oak wilt pathogen with leaf wilt and vascular water flow resistance.** Phytopathology 61: 1003-1005.

Isolations and water flow-rate measurements made on short stem sections of young red oak seedlings inoculated with the oak wilt pathogen, *Ceratocystis fagacearum,* about 1 to 2 inches above the soil line, revealed that the oak wilt pathogen was isolable first near the inoculation site. As time after inoculation increased, the pathogen was isolated progressively farther up the stem until, when leaf symptoms became visible, it was present throughout the stem. At the onset of leaf symptoms, many but not all petioles contained the pathogen.

*Gregory, Garold F., and Keith F. Jensen.
1971. **A modified Lowry protein test for dilute protein solutions.** USDA Forest Serv. Res. Note NE-136. 3 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A modified Lowry protein test was compared with the standard Lowry protein test. The modified test was found to give estimates of protein concentration that were as good as the standard test and has the advantage that proteins can be measured in very dilute solutions.

*Gregory, Garold F., Thomas W. Jones, and Percy McWain.
1971. **Injection of benomyl into elm, oak, and maple.** USDA Forest Serv. Res. Pap. NE-232. 7 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A newly devised apparatus using pressure to inject fluids into trees was used to inject solubilized benomyl into elms, oaks, and maples. One to 3 weeks after injection, the trees were sampled; and positive bioassays were obtained from branch tips of some trees. Injection of benomyl into elms, oaks, and maples may provide protection from infection by fungal pathogens or may provide therapy for diseased trees.

Hock, W. K., and L. S. Dochinger.
1971. **Chemotherapeutic control of stem crown gall of Sherrill hybrid poplar trees.** (Abstr.) Phytopathology 61: 129.

Crown gall on stems of Sherrill hybrid poplar (*Populus grandidentala* X *P. alba*) cuttings was partially controlled by a coordination product of 2, 4-xylenol and meta-cresol (Bacticin) applied topically to neoplasms. Bacticin completely inhibited further gall development on 50 percent of the trees after three treatments. Bacticin appears to have a high affinity for galled tissues, and possesses chemotherapeutic properties. By manipulating the timing and number of applications, perhaps greater control of crown gall by Bacticin can be achieved.

Houston, D. R.
1971. **Chemical limitation of discoloration and decay associated with wounds in red maple and yellow birch.** (Abstr.) Phytopathology 61: 889.

Chemicals, including fungicides, antibiotics, glue, and paraformaldehyde, were placed immediately into increment-borer wounds made in 65 red maple and 35 yellow birch trees in New Hampshire. Three years later, the trees were dissected, the vertical extent of the discoloration and decay associated with the wounds was measured, and microorganisms were isolated. Discoloration in both species was reduced significantly by chemicals. Red maple wounds treated with glue, and yellow birch wounds treated with glue or Methocel, had the least discoloration.

Houston, David R.
1971. **Discoloration and decay in red maple and yellow birch: reduction through wound treatment.** Forest Sci. 17: 402-406, illus.

Several chemicals were introduced into fresh increment borer wounds in red maple and yellow birch. After 3 years, study trees were felled and dissected. Longitudinal extent of discoloration and decay columns associated with wounds were measured. Isolations were made for identifying microorganisms. Tested chemicals generally reduced the extent of discoloration and decay. Although wide variations occurred, some chemicals appeared to retard development of discoloration by restricting entrance of air to the wound.

*Houston, David R.
1971. **Noninfectious diseases of oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 118-123. Upper Darby, Pa.

Noninfectious diseases arise primarily from the harmful effects of wound agents, chemical, and adverse environmental factors. Wounds directly

result in damage to trees, but they are important primarily as infection courts for pathogenic organisms. Adverse environmental factors affect trees both directly and indirectly. Trees weakened by environmental stresses become susceptible to insects and fungi that normally are unable to attack. These "declines" of oak have occurred frequently in the Northeast and Southeast and will probably increase as concern for environmental quality restricts the use of pesticides.

*Jensen, Keith F.
1971. **Cellulolytic enzymes of *Stereum gausapatum*.** Phytopathology 61: 134-138.

The cellulase systems produced by *Stereum gausapatum* had similar pH and temperature stability and activity relationships regardless of whether they were produced on a sawdust substrate or in liquid medium with either cellulose or carboxymethylcellulose as the carbon source. The system has a pH optimum between 4 and 5 and a temperature optimum of 50°C. Dry weight production and cellulase activity varied with both cultural conditions and media substrate. The cellulase system was separated into two components: a cellobiase and a Cx cellulase.

*Jensen, Keith F., and Phillip E. Reynolds.
1971. **Response of *Fusarium solani* to fluctuating temperatures.** USDA Forest Serv. Res. Pap. NE-210. 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The growth-temperature relationships of six isolates of *Fusarium solani* were measured, using both constant and fluctuating temperature treatments in liquid and agar culture. A comparison of growth under fluctuating and constant temperature suggests that temperature fluctuation by itself in some cases may cause an increase in growth. Liquid cultures of *F. solani* gave a wider range of growth differences to temperature treatments than agar cultures.

*Jones, Jerry K.
1971. **Seasonal recovery of chlorotic needles in Scotch pine.** USDA Forest Serv. Res. Pap. NE-184. 9 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Color changes in the needles of three geographic races of Scotch pine were studied during the period from February to April. Chloroplast pigments and nitrogen were analyzed and related to seasonal discoloration. It was found that discoloration is caused primarily by the loss of chlorophyll, and that a sharp increase in chlorophyll concentration accompanies the return to summer green. No evidence was found of discoloration due to nitrogen deficiency.

*Jones, Thomas W.
1971. **An appraisal of oak wilt control programs in Pennsylvania and West Virginia.** USDA Forest Serv. Res. Pap. NE-204. 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The Pennsylvania program reduced fungus spread on study plots by 90 percent but at a high cost in healthy trees destroyed. The West Virginia program reduced fungus spread on study plots by 79 percent in the southern part of the State, but was ineffective in the northeastern part. The study measured the effect of each program on local spread of the fungus but did not adequately measure control treatment impact on long-distance spread.

*Jones, Thomas W., and Garold F. Gregory.
1971. **An apparatus for pressure injection of solutions into trees.** USDA Forest Serv. Res. Paper NE-233. 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The construction and use of an apparatus for injecting solutions under pressure into trees is described. A unique and important feature of the apparatus is that it permits injection of solutions into the outermost sapwood. It has been used to inject dye solutions and solubilized benomyl into elm, oak, and maple.

*McWain, Percy, and Garold F. Gregory.
1971. **Solubilization of benomyl for xylem injection in vascular wilt disease control.** USDA Forest Serv. Res. Pap. NE-234. 6 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Benomyl in varying amounts was solubilized in several solvents, thus allowing injection into trees for fungus-disease prevention and therapy. A large amount of benomyl can be solubilized in diluted lactic acid. The resulting solution can be infinitely diluted with water without precipitation. These characteristics make it the current solution of choice for tree-injection studies.

Parker, Johnson.
1971. **An unusual tonoplast in conifer leaves.** Nature 234(5326): 231.

A lipidic layer about $1/2\mu$ thick was discovered with the electron microscope between the cyto-

plasm and the vacuole of chlorenchyma cells. Such a layer is absent in leaves of various deciduous trees such as ash, elm, and maple. The layer strains with either $KMnO_4$ or OsO_4. It may enhance the drought resistance of conifer leaves.

*Parker, Johnson, and David R. Houston.
1971. **Effects of repeated defoliation on root and root collar extractives of sugar maple trees.** Forest Sci. 17: 91-95, illus.

Extractive levels of cell content materials from the roots of sugar maple trees defoliated in June and harvested in July, August, or November were lower than levels from roots of undefoliated controls. Defoliation had no apparent effect on extractive levels in root collar bark. The amount of glucose and fructose markedly increased in roots of defoliated trees, and the amount of starch declined.

*Rexrode, Charles O.
1971. **Insect damage to oaks.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 129-134, illus. Upper Darby, Pa.

In terms of mortality caused by insects, defoliators are the most serious enemies of oaks at present. An oak leaf tier, *Croesia semipurpurana,* is one of the principal defoliators of trees in the red oak group. Oak leaf rollers, primarily *Archips semiferana,* have been responsible for widespread mortality in white and chestnut oaks. Defoliation by the gypsy moth, *Porthetria dispar,* could become the major insect problem in the Appalachian Region and possibly throughout the eastern United States. Economically, wood borers may be the most important at present.

*Rexrode, Charles O., and Thomas W. Jones.
1971. **Oak bark beetles carry the oak wilt fungus in early spring.** USDA Plant Dis. Rep. 55: 108-111.

The oak bark beetles *Pseudopityophthorus minutissimus* in Missouri and *P. pruinosus* in West Virginia carry the oak wilt fungus *Ceratocystis fagacearum* Hunt when they emerge in April and May after overwintering in wilt-killed trees. Beetles from 47 percent of all trees sampled carried the fungus. The percentage of contaminated beetles emerging from wilt-killed trees ranged from 0 to 33. Some beetles carry the fungus internally, and immature beetles and beetle excreta contain propagules of the fungus.

Rexrode, Charles O., and Thomas W. Jones.
1971. **Oak bark beetle attacks on oak wilt trees in Missouri.** Environ. Entomol. 1:57-58.

In southeastern Missouri, 66 oaks infected with the oak wilt fungus, *Ceratocystis fagacearum* (Bretz) Hunt, were girdled, felled, or left standing. The effects of these treatments on attacks by oak bark beetles, *Pseudopityophthorus* spp., were determined. All trees were attacked by bark beetles. The beetles made brood galleries in 41 of the 44 girdled and felled wilt trees, but in only 11 of the 22 untreated wilt trees.

Rexrode, C. O., R. P. True, and R. R. Jones.
1971. **Influence of three herbicides on mat production and bark beetle attack in oak wilt trees.** USDA Plant Dis. Rep. 55: 1106-1107.

In northeastern West Virginia, 53 oaks naturally infected with the oak wilt fungus *Ceratocystis fagacearum* (Bretz) Hunt, were treated with the dimethylamine salt of 2,4-D, picloram + 2,4-D, or cacodylic acid + arsenic. Mat production was less on the 2,4-D treated trees than on the trees attacked; and the density of oak bark beetle (*Pseudopityophthorus* sp.) attacks were higher on the treated trees than on the untreated trees.

Rier, John P., and Alex L. Shigo.
1971. **Some early wounding responses in red maple, *Acer rubrum.*** (Abstr.) Amer. J. Bot. 58:456.

Fluorescence microscopy was used to show that within 34 days after wounding red maple, *Acer rubrum,* callose accumulated in the phloem, new xylary tissues formed, and plugs formed in vessels to 10 cm. above and below the wounds.

Roberts, B. R., A. M. Townsend, and L. S. Dochinger.
1971. **Photosynthetic response to SO_2 fumigation in red maple.** (Abstr. Paper 179). Plant Physiol. 47: 30.

Five-month-old seedlings of red maple (*Acer rubrum* L.) were fumigated with sulfur dioxide in a controlled environment for 4 to 6 hours prior to measuring net photosynthesis. Concentrations of 6 ppm. SO_2 caused acute foliar necrosis and resulted in depressed rates of photosynthesis. Plants fumigated at lower SO_2 levels (1 ppm.) exhibited no foliar injury and showed a slight stimulation in CO_2 exchange when compared to unfumigated controls. Post-fumigation recovery of maple seedlings exposed to 4.5 ppm. SO_2 for 6 hours was also studied.

Shigo, Alex L.

1971. **The beech bark disease spreads southward.** S. Lumberman 223(2776): 83, illus.

The beech bark disease, caused by the fungus *Nectria coccinea* var. *faginata,* which infects wounds made by the beech scale *Cryptococcus fagi,* is now in Pennsylvania and is spreading southward. For a long time little attention was paid to the disease because beech was considered a low-value tree. The big question is: how will warmer climates affect the disease? It may spread more rapidly.

*Shigo, Alex L.

1971. **Discoloration & decay in oak.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 135-141. Upper Darby, Pa.

Diseases that result in discoloration and decay of wood are major problems affecting all species of oak. Wounds often start the processes that can lead to these diseases. The type and severity of the wound, the vigor of the tree, the environment, and the aggressiveness of microorganisms that infect are some of the most important factors that determine the nature of the disease. Decay following fire wounds and decay in sprout stems has caused the major defects in oak. Now discolorations and other defects once considered minor are becoming more important.

Shigo, Alex L.

1971. **Shakes associated with wounds in trees.** IUFRO Congr. 15, 5 p. Gainesville, Fla.

All shakes were associated with wounds, but all wounds did not develop shakes. The ring shake zone was the barrier zone formed by the cambium after wounding.

Shigo, Alex L.

1971. **The beech bark disease in northeastern United States.** IUFRO Congr. 15, 8 p. Gainesville, Fla.

A summary of what is known about the beech bark disease as it exists in the northeastern United States.

Shigo, Alex L.

1971. **Successions of microorganisms and patterns of discoloration and decay following wounding in deciduous hardwoods.** Indian Agr. Res. Inst. Int. Symp. Plant Pathol. Proc. 2: 175. New Delhi.

Summary of recent information about discoloration and decay in deciduous trees.

Shigo, Alex L.

1971. **Successions of microorganisms and patterns of discoloration and decay after wounding in red oak and white oak.** (Abstr.) Phytopathology 61:910.

Discoloration and decay are compartmentalized within the tissues present at the time of wounding, and successions of microorganisms follow wounding in oaks.

*Shigo, Alex L., Joseph Stankewich, and Benjamin J. Cosenza.

1971. **Clostridium sp. associated with discolored tissues in living oaks.** Phytopathology 61: 122-123, illus.

Droplets oozing from discolored tissues on the end of bolts cut immediately after oak trees were felled contained an anaerobe, *Clostridium* sp., in addition to facultative bacteria.

*Shigo, Alex L., and Charles L. Wilson.

1971. **Are tree wound dressings beneficial?** Arborist's News, Int. Shade Tree Conf. 36: 85-88, illus.

A discussion pointing out what we do not know about tree-wound dressings and what we do know about decay associated with wounds. Some new approaches to the old problem of preventing decay associated with wounds.

Stankewich, Joseph P., Benjamin J. Cosenza, and Alex L. Shigo.

1971. ***Clostridium quercicolum* sp. n., isolated from discolored tissues in living oak trees.** Antonie van Leeuwenhoek 37:299-302.

The anaerobic bacterium isolated from oak trees was named as a new species, *Clostridium quercicolum.*

Wargo, Philip M.

1971. **Enhanced growth of *Armillaria mellea* on extracts from roots of defoliated sugar maple trees.** (Abstr.) Phytopathology 61: 915.

Defoliation of trees by insects appears to predispose them to attack by *Armillaria mellea.* Certain sugars, amino acids, and fatty acids that occur in roots stimulate growth of *A. mellea* in vitro. Defoliation can alter some of these chemical constituents, and these changes may be related to increased attack of defoliated trees by *A. mellea.* It appears that defoliation causes chemical changes

in the outer wood of roots that are favorable for the growth of *A. mellea.*

*Wargo, Philip M.
1971. **Seasonal changes in carbohydrate levels in roots of sugar maple.** USDA Forest Serv. Res. Pap. NE-213. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Starch, sucrose, glucose, and fructose were present in roots of sugar maple trees throughout the year. Starch and sucrose concentrations were highest in the fall and lowest just after budbreak in spring. Except for a brief fall decrease, glucose and fructose levels were fairly constant. Stachyose, raffinose, and maltose were present only from late summer to late spring and were at maximum levels in mid-winter.

Wilson, Charles L., Carl E. Seliskar, and Charles R. Krause.
1971. **Mycoplasmalike bodies associated with elm phloem necrosis.** Phytopathology 62: 140-143.

Mycoplasmalike bodies were found associated with phloem cells in the roots and stems of American elms (*Ulmus americana*) infected by the elm phloem necrosis agent, but not in healthy elms. These bodies were limited by tripartite membranes (about 8 nm) and varied in diameter from 200 to 1,000 nm. They exhibited pleomorphic forms plus internal morphology typical of mycoplasmas. No virus particles were seen in phloem necrosis-diseased cells; however, numerous phloem elements were filled with plant protein.

WATERSHED MANAGEMENT

*Aubertin, G. M.
1971. **Nature and extent of macropores in forest soils and their influence on subsurface water movement.** USDA Forest Serv. Res. Pap. NE-192. 33 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Water rapidly entered the soil and moved considerable distances downslope through macropores. Subsurface water moved through old root channels in relatively dry, fine-textured soils, while the soil surrounding the channels remained dry. Observations revealed that the number, degree of formation, and persistence of old root channels were greater in the finer textured soils. Information is presented on types, amount, and distribution of macropores within forested soils.

Corbett, E. S.
1971. **Status of management on forested municipal watersheds in Northeast.** Pa. Forests 62(4): 100-101, illus.

A report on results of a recent survey to determine the extent of forested municipal watersheds and ownership patterns, management practices, problems, and research needs.

*Curtis, Willie R.
1971. **Strip-mining, erosion and sedimentation.** Amer. Soc. Agr. Eng. Trans. 14(3): 434-436, illus.

The effects of strip-mining on the water resources of small mountain watersheds are being studied in eastern Kentucky. Of these effects, erosion and sedimentation are perhaps the most important. Study showed that maximum sediment yields occurred during active mining operations but decreased in a few months after completion of mining. Suspended sediment yields of over 46,000 ppm. were observed from one watershed. Bedload from one watershed, measured as deposits in the weirs, amounted to 66,500 cubic feet per square mile of drainage area over a 2-year period.

*Curtis, Willie R.
1971. **Terraces reduce runoff and erosion on surface-mine benches.** J. Soil and Water Conserv. 26(5): 198-199, illus.

A two-year study in Breathitt County, Kentucky, indicated that terraces can effectively control runoff and erosion on surface-mine benches. In an area where the spoil was predominantly shale, peak flows on a terraced plot averaged 65 percent less than on the control plot, sediment yield averaged 52 percent less, and total runoff averaged 42 percent less. Comparable figures on a set of plots having substantial amounts of sandstone were 65, 70, and 6 percent respectively. Average storm runoff duration was 1 percent higher on the terraced plot of each pair.

Davis, Grant (ed).
1971. **A guide for revegetating bituminous strip-mine spoils in Pennsylvania.** Res. Comm. on Coal Mine Spoil Revegetation in Pennsylvania (revised 1971). 46 pp., illus.

This guide brings together in one publication the most up-to-date information available about the revegetation of bituminous mine spoils. It includes sections on legislation related to strip-mining, the characteristics and classification of spoils, revegetation planning, and reclamation for woodland, agriculture, wildlife, and recreational uses.

*Federer, C. A.
1971. **Solar radiation absorption by leafless hardwood forests.** Agr. Meteorol. 9(6): 3-20, illus.

Field data from three forests verified a theoretical model for absorption, reflection, and transmission of solar radiation by leafless hardwood canopies. When snow is on the ground, roughly 65 percent of the incident radiation is absorbed by stems and branches and 20 percent is reflected; the remaining 15 percent is absorbed by the snow. However, these proportions vary greatly depending on solar zenith, ratio of direct to diffuse radiation, ground or snow albedo, and canopy characteristics.

Federer, C. A., and R. E. Leonard.
1971. **Snowmelt in hardwood forests.** Eastern Snow Conf. Proc. 1971: 95-109.

Snowmelt differences among forest covers result from differences in energy transfer by solar and longwave radiation, convection, and condensation-evaporation. Effects of temperature, humidity, and wind speed are discussed. Transport of melt water through the soil to a stream can be modelled by an electrical analog, so snowmelt rate can be estimated from measured streamflow.

Ketchledge, E. H., and R. E. Leonard.
1971. **Progress report: high peak erosion studies.** Adirondack Mt. Club Adirondack Peeks 8 (2): 8-10.

A brief review of the problems of trail erosion on the steeper mountain slopes and the research now being done on use of vegetation and fertilizer to restore worn trails. Hikers have been enlisted to help in efforts to protect and maintain trails.

Kochenderfer, James N.
1971. **Some hydrologic effects of clearcutting forested watersheds.** (Abstr.) W. Va. Geobotany Conf. Proc.: 3.

Clearcutting forested watersheds in the eastern U. S. can be expected in increase water yields, mainly in summer months of normally low flow. Since most soil disturbance is due to road construction, most damage can be avoided by careful construction and use of logging roads. A rise in stream temperature can be prevented by leaving shade adjacent to channels.

Kochenderfer, James N.
1971. **Erosion control on logging roads.** N. Y. Forester 28(1): 8. N. Y. Sect. Soc. Amer. Forest.

Comments on adequacy of erosion-control measures on lands of the International Paper Company near Old Forge, N. Y.

Leaf, Albert L., and Raymond E. Leonard.
1971. **A rational approach to forest treatments.** S. Lumberman 223(2776): 169.

The philosophy of forest treatments must change from one of trial and error to one involving an assessment of the total ecosystem. Research must provide managers with the best available basic information about the physical and biological processes and their interrelationships.

*Leaf, Albert L., Raymond E. Leonard, and John V. Berglund.
1971. **Root distribution of a plantation-grown red pine in an outwash soil.** Ecology 52(1): 153-158, illus.

Root distribution and mass of a single dominant sample tree (17 m. high, 20 cm. diameter) in a 39-year-old *Pinus resinosa* Ait. plantation supported by a deep, stratified, outwash sandy soil were related to soil horizonation characteristics and above-ground tree components (foliage, branches, bolebark, and bolewood). All roots were excavated by hand in the A_p and B horizons and by 0.3-m. depths in the C strata, were separated into five size classes, cleaned, dried, and weighed. Total root weight was approximately twice the total needle weight.

Leaf, A. L., and R. E. Leonard, et al.
1970. **Growth and development of *Pinus resinosa* plantations subjected to irrigation-fertilization treatments.** N. Amer. Forest Soils Conf. Proc. 3: 97-118.

Some tree growth and development-soil physical environment relationships have been demonstrated in 37-year-old red pine plantations supported by known K-deficient deep sandy outwash soil. Irrigation and K-fertilization trials, singly and in combination, were initiated on this site in 1966. The effects of these treatments were evaluated by monitoring changes in moisture, temperature, and nutrient element regimes in the soil, as well as changes in height and diameter inter- and intra-seasonal increment and foliar nutrient levels.

*Leonard, Raymond E., Albert L. Leaf, John V. Berglund, and Phillip J. Craul.
1971. **Annual soil moisture-temperature patterns as influenced by irrigation.** Soil Sci. III(4): 220-227, illus.

Irrigation water was applied at the rate of 5-area-cm. every 15 days from June 1 through September 1 for 3 years to a sandy outwash soil in northern New York with a forest cover of 40-year-old red pine plantations. Frequent monitoring of soil moisture and soil temperature at several depths during 1966-68 illustrates the annual patterns of these soil properties and their changes resulting from treatment. The addition of 35-area-cm. of water per year resulted in maintaining soil-moisture levels approaching those shortly after spring snow melt. This treatment also modified soil temperature below the 20-cm. depth by extending the period of higher temperatures.

*Patric, James H.
1971. **Herbicides and water quality in American forestry.** NE. Weed Sci. Soc. Proc. 25: 365-375.

Scientific literature was reviewed to evaluate effects of forest herbicide use on water quality. No report suggested that proper herbicide use has limited the usefulness of water in forest streams. The long-term effects of herbicide use on water quality are unknown. Some rules are suggested for minimizing water pollution by herbicides applied in forests.

*Patric, James H., and Kenneth G. Reinhart.
1971. **Hydrologic effects of deforesting two mountain watersheds in West Virginia.** Water Resources Res. 7: 1182-1188, illus.

Maintaining halves of two watersheds barren for several years raised stream levels consistently higher than experienced under forest. Water yields increased about 6 inches annually after cutting either upper or lower halves of these watersheds. Most of the increase occurred as augmented low flow during the growing season. Qualitative changes in streams, however, always were greatest after cutting lower halves containing most of the stream channels. Water temperature, turbidity, and specific conductance were somewhat higher following channel exposure.

*Pierce, Robert S.
1971. **Clear cutting and stream water.** N.H. Forest Notes 106: 9, 13.

Radical changes in water quantity and quality resulted when a forested watershed was cleared and sprayed with herbicides for 3 successive summers to eliminate regrowth. Possible environmental implications are discussed for areas subjected to commercial clearcutting. Types of studies under way to determine the magnitude of these changes on manipulated lands are described.

*Reinhart, Kenneth G.
1971. **What's new in forest influences on the environment.** Soc. Amer. Forest. Allegheny Sect. Winter Meeting Proc.: 7-10.

A summary report on recent developments on origin of streamflow, water yield and quality, urban problems, and other phases of forest influence on the environment.

*Van Lear, David H.
1971. **Effects of spoil texture on growth of K-31 tall fescue.** USDA Forest Serv. Res. Note NE-141. 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Growth of K-31 tall fescue (*Festuca arundinacea*) was significantly affected by the texture, of four spoils from eastern Kentucky. Growth on spoils having no toxic chemical properties generally was greatest where texture consisted of about equal quantities of soil-size material and a coarser fraction (2 mm. to 6.4 mm.), probably because moisture and aeration were favorable.

Young, Cortland E., Jr., Ralph A. Klawitter, and James E. Henderson.
1971. **Hydrologic model of a wetland forest—details of construction.** USDA Forest Serv. Res. Note SE-166. 4 pp., illus. SE. Forest Exp. Sta., Asheville, N. C.

Details of construction and a bill of materials for a model of the hydrologic cycle on a wetland forest of the southeastern coastal plain.

FOREST RECREATION

Beardsley, Wendell G.
1971. **The economic impact of recreation development: A synopsis.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 28-32.

Economic impacts per dollar of tourist expenditure are generally low compared to other economic sectors in local less-developed areas where recreation development is often proposed as a stimulus for economic growth. However, tourism can be economically important where potential or existing recreation attractions can encourage tourist spending in amounts large enough to offset these lower per-dollar impacts.

Bevins, Malcolm I.
1971. **Private recreation enterprise economics.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 33-39.

Cash returns to recreation enterprise labor and management are low. Low returns are associated with poor location, small size, and short season. Land-value appreciation may offset low returns for some operators and explain why they stay in business. Profit maximization is not always the prime entrepreneurial goal: personal and non-economic considerations or long-run capital gain may have an overriding effect. This situation could change if low returns were coupled with high property taxation over a prolonged period.

Clark, Roger N.
1971. **Undesirable behavior in forest campgrounds.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 150-155.

A 3-year study indicates that nuisance behavior, law violations, vandalism, and littering in forest campgrounds are more extensive than is generally believed. Violations occur because of ignorance of, lack of understanding of, or a willingness to disregard rules. Control measures are discussed, including an incentive system utilizing monetary and nonmonetary rewards, which was used successfully to control littering in a large forest campground.

Cole, Gerald L., and Bruce T. Wilkins.
1971. **The camper.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 105-112.

A profile of socio-economic characteristics of campers is discussed, together with some of the reasons why they camp. Management implications are offered for public-agency personnel, based upon current trends in the camping market and the decision about what kinds of campers should be attracted to public campgrounds.

Davis, Hugh C.
1971. **The recreation-resource inventory process for state and regional plans.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 1-4.

The establishment of guidelines for identifying recreation resources in the inventorying process should be limited to conditions and characteristics of the natural resources themselves. This requires not only that we define recreation, but also that we prescribe the combination of resources necessary to carry on a variety of recreational activities.

*Echelberger, Herbert E.
1971. **Vegetative changes at Adirondack campgrounds, 1964 to 1969.** USDA Forest Serv. Res. Note NE-142. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The vegetation on campsites in the Adirondacks was measured and mapped, and changes in vegetation on the sites were studied from 1964 to 1969. Results indicate that well-maintained sites deteriorated little during the study period.

Fabos, Julius Gy.
1971. **An analysis of environmental quality ranking systems.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 40-55.

A review and analysis of the quantitative ranking systems that have been developed during the past decade for measuring environmental quality.

Hadley, Lawrence C.
1971. **Perspectives on law enforcement in recreation areas.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 156-160.

The nature and scope of law-enforcement problems in the National Park System are of increasing concern to park and recreation area managers. Law enforcement must be carried out in perspective with other management programs and developed with sensitivity to the changing nature of society and the changing needs and interests of park users.

Hamilton, John F., Jr.
1971. **An opinion about the future of forest recreation research.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 194-196.

A discussion of the research environment, with emphasis on the quality of future research. Some current research attitudes are criticized and a suggestion is given for increasing the value of research.

Heinselman, Miron L.
1971. **Preserving nature in forested wilderness areas and national parks.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 57-67.

The natural forest ecosystems of some of our national parks and wilderness areas are endangered by subtle ecological changes, primarily because we have failed to understand the dynamic nature of these ecosystems and because protection programs frequently have excluded the very factors that produce natural plant and animal communities. Maintaining natural ecosystems requires that the elemental forces of the past, such as fire, must still prevail.

Hendee, John C.
1971. **Membership in conservation groups and outdoor clubs.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 123-127.

Conservation groups and outdoor clubs are a major influence on natural resource policy through their articulate members. Different kinds of groups are described — their memberships, representativeness, potential growth, multiple memberships, and comparability with other voluntary organizations.

Hetherington, John W.
1971. **The snowmobile.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 143-148.

As use of the snowmobile has increased — nearly 1½ million now in use — the development and maintenance of snowmobile use areas has become a concern. A study calls attention to safety problems, costs, trail design and maintenance, sign systems, rules and aids for snowmobilers, safety patrol and other services, and safeguards for the environment.

Hopkins, Walter S.
1971. **Expanding and strengthening outdoor recreation research.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 197-199.

Though the Forest Service has pioneered in outdoor recreation research, the funding for recreation research has been inadequate. Specific needs for research are outlined. There is a need to define recreation and recreation research in terms that busy legislators can understand.

James, George A.
1971. **Inventorying recreation use.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 78-95.

A general discussion about estimation of recreation use, with descriptions of selected sampling techniques for estimating recreation use on a wide variety of different sites and areas; and a brief discussion of an operational computer-oriented information system designed and developed by the USDA Forest Service to fully utilize the inventories of recreation information available from over 21,000 recreation elements (sites and areas) of the National Forest System.

Ketchledge, Edwin H.
1971. **Facility rehabilitation.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 166-173, illus.

Restoration of vegetation on damaged sites is the most perplexing challenge in facility rehabilitation. In the Adirondack Mountains, the ecological impact of recreationists on the natural environment has become critical in two high-quality interior areas: on the steep higher slopes where trails soon become eroding stream channels, washing away the thin mountain soils; and on the open summits where the fragile alpine communities are trampled by traffic from below.

LaPage, Wilbur F.
1971. **Cultural "fogweed" and outdoor recreation research.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 186-193.

A critical look at outdoor recreation research and some underlying premises. The author focuses on the concept of culture as communication and how it influences our perception of problems and our search for solutions. Both outdoor recreation and science are viewed as subcultures that have their own bodies of mythology, making recreation problems more difficult to define and resolve.

*LaPage, Wilbur F., and Edward G. Fisher.
1971. **Geographical variation in camper expenditures.** USDA Forest Serv. Res. Note NE-139. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Daily expenditures by families camping in New Hampshire state parks in 1967 averaged $11.81. Considerable variation was found between the northern, central, and southern regions of the State in both the average amount of money spent and the way in which the money was spent. Daily expenditures in the north were higher, but average visit lengths were shorter, resulting in less local spending per family. The ratio of campground visit length to total trip length is shown to vary with several categories of trip expenditure.

*LaPage, Wilbur F., and Dale P. Ragain.
1971. **Trends in camping participation.** USDA Forest Serv. Res. Pap. NE-183. 22 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Camping participation patterns were studied for a panel of 565 campers who for 5 years annually submitted a summary of their outdoor recreational activities. From 1964 to 1969, one-third of the panel members showed a marked decline in their camping participation. Only one-sixth reported a real increase in camping. To explain both the trend and volume of the panel's camping participation, three broad categories of behavioral influences were studied.

*LaPage, Wilbur F., and Dale P. Ragain.
1971. **A second look at the heavy half of the camping market.** USDA Forest Serv. Res. Pap. NE-196. 9 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Annual camping participation figures supplied by a panel of over 500 campers for 4 years were used to make a detailed study of the heavy half of a camping market. In 3 out of 4 years, the heavy half did more than 80 percent of all reported camping. A decreasing trend in camping participation was found to be strongly and inversely related to the number of years a camper was in the heavy half of the camping market.

Leuschner, William A., and Roscoe B. Herrington.
1971. **The skier: his characteristics and preferences.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 135-142, illus.

Skiers are young and becoming younger, with increasing proportions of unmarried and female skiers. Many are students, and roughly half of the remainder earn their livings as professionals (doctor, lawyer, teacher). Skiers have higher-than-average incomes. Day skiers ranked proximity as the most important reason for skiing at a particular area. The physical quality of ski slopes (not including snow quality) was ranked second by the day skier and first by skiers planning weekend and vacation trips.

Lime, David W., and George H. Stankey.
1971. **Carrying capacity: maintaining outdoor recreation quality.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 174-184.

A discussion of: (1) what is meant by the concept of recreational carrying capacity; (2) what is known about capacities in terms of both how resources and experience of visitors are affected by recreational use; and (3) what alternative procedures the administrator can use to manage both resources and visitors for capacity.

Lucas, Robert C.
1971. **Hikers and other trail users.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 113-122.

Trail users seem neglected. Trail systems are limited, largely relics of fire control rather than designed for recreation; and total trail miles are probably declining. On the other hand, participation in various kinds of trail-oriented recreation is substantial and growing. Most activity is for short periods of time close to participants' homes. A varied and diffuse trail system, with an emphasis on opportunities near urban areas, is needed.

*Moeller, George H.
1971. **Growth of the camping market in the Northeast.** USDA Forest Serv. Res. Pap. NE-202. 21 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The pattern of commercial and public campground growth in the Northeast over a 6-year period was examined to relate growth to geographic features, population distribution, and existing campground locations. Aspects of market complementarity between public and commercial campground development are also discussed. Past campground market growth trends are extrapolated to provide insight into future market relationships.

*Moeller, George H.
1971. **The landowner and the snowmobiler — problem or profit?** USDA Forest Serv. Res. Pap. NE-206. 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

As interest in snowmobiling grows, and as land areas available for snowmobile use are restricted,

the owner of open land may be able to make a profit by providing facilities for this new type of recreation. Case studies were made of eight commercial snowmobile enterprises in central New York State. Management problems are discussed, and the factors that the landowner should consider before going into the business are outlined.

Morrison, Douglas A., and George H. Moeller.
1971. **Hints in requesting campground information.** State Univ. N. Y. Coll. Forestry Dep. Resources Manage. 7 p. Syracuse, N. Y.

Information was requested by mail from 200 campground operators, about half in the Adirondacks and the other half in southeastern Pennsylvania. Study of the responses led to these main conclusions: a request made in the spring has a 10-percent better chance of getting a reply than a request in winter; and a letter brings a more thoughtful and personal response than a postcard.

Newby, Floyd L.
1971. **Understanding the visual resource.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 68-72.

Understanding visual resources involves a complex interweaving of motivation and cognitive processes; but, more important, it requires that we understand and can identify those characteristics of a landscape that influence the image formation process. From research conducted in Florida, three major variables were identified that appear to have significant effect upon visual preferences: (1) visual order, (2) visual complexity, and (3) edge relationships.

*Northeastern Forest Experiment Station.
1971. **Recreation Symposium Proceedings.** 211 pp. USDA Forest Serv. NE. Forest Exp. Sta., Upper Darby, Pa.

A record of the Symposium on Forest Recreation held in October 1971 at Syracuse, N. Y., containing 26 papers on various aspects of recreation research, including (1) planning and developing the recreation resource, (2) managing the recreation resource, (3) characteristics of the recreationist, (4) managerial considerations, and (5) a look at the research task ahead.

Orr, Howard R.
1971. **Design & layout of recreation facilities.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 23-27.
Design and layout of recreation facilities is a problem-solving process that must be divorced from the emotionalism that has shrouded outdoor recreation and must deal deliberately with the growing information concerning people and natural resources.

Prausa, Robert L.
1971. **Multiple-use management for recreation in the East.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 96-102, illus.

An overview of the complex management problems that confront the administrator of national forest lands in the eastern United States, with emphasis on the conflicts that occur and will intensify as a result of the many demands for different kinds of recreation opportunities on National Forest System lands. The need to identify and measure the kinds of recreation opportunities these lands can provide is brought out.

Shafer, Elwood L.
1971. **Surveys in recreation research.** Pa. Dep. Environ. Resources Foresters Conf. Proc.: 28-32.

The steps in conducting recreation surveys are outlined. A list of do's and don't's concerning survey design, interview procedures, and question wording.

Shafer, Elwood L., Jr., and George Moeller.
1971. **Predicting quantitative and qualitative values of recreation participation.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 5-22.

If future recreation consumption and associated intangible values can be predicted, the problem of rapid decision-making in recreation-resource management can be reduced, and the problems of implementing those decisions can be anticipated. Management and research responsibilities for meeting recreation demand are discussed, and proved methods for forecasting recreation use and associated qualitative values are presented.

Shafer, Elwood L., and Rita M. Rammrath.
1971. **Outdoor recreation use.** Trends 8(4): 22-25, illus.

Recreation demand is examined briefly across an urban-suburban-rural spectrum. Renovations of present research efforts are needed if forest managers are to meet society's demands for forest recreation, bring people closer to nature, and yet avoid the pitfalls of polluting outdoor recreation environments.

Tombaugh, Larry W.
1971. **External benefits of natural environments.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 73-77.

Existing methods of assessing economic benefits arising from certain physical environments left in a relatively natural condition do not include estimates of external benefits. Existence value is one such external benefit that accrues to individuals who have no intention of ever visiting the area in question. A partial measure of the existence value of National Parks has been found. Additional research in this area should yield information important to land-use decision-making.

Uleck, Ronald B.
1971. **The challenge of recreation planning: methodology and factors to consider.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 200-211, illus.

The proposed methodology of planning is a description, explanation, and justification of the methods or techniques that a planner should use in preparing outdoor recreation development plans. The sequence of steps required is described.

Wagar, J. Alan.
1971. **Communicating with recreationists.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 161-165.

Recreationists are free to ignore many of a land manager's communication efforts. Greatest effectiveness can be expected for presentations that are dynamic and are tailored to the interests and other characteristics of selected visitor groups, that permit participation and reward learning, and that provide both an idea of what is coming and a framework to give it coherence.

*Whittaker, James C., and Herbert E. Echelberger.
1971. **Land for recreation: a look at leasing in New York.** USDA Forest Serv. Res. Pap. NE-182. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on a survey of individuals and groups who lease private land for recreational uses in New York State, based on a questionnaire survey to find out how and why they leased land.

ENVIRONMENTAL FORESTRY RESEARCH

*Federer, C. A.
1971. **Effects of trees in modifying urban microclimate.** *In* **Trees and forests in an urbanizing environment.** Univ. Mass. Coop. Ext. Serv. Planning and Resource Develop. Ser. 17: 23-28, illus.

The microclimate of a human individual includes those factors that affect his skin temperature and thus his senses of warmth and cold. Trees modify this microclimate by providing shade, by increasing longwave radiation, by reducing wind, by interception of rain and snow, and by cooling the air by transpiration. All these effects are usually beneficial to man. Evening city temperatures are often warmer in summer than surrounding vegetated areas. Parks, greenbelts, and scattered trees can influence the microclimate outside their immediate areas.

*Leonard, Raymond E.
1971. **Effects of trees and forests in noise abatement.** *In* **Trees and forests in an urbanizing environment.** Univ. Mass. Coop. Ext. Serv. Planning and Resource Develop. Ser. 17: 35-38.

Noise levels in urban areas are at best a nuisance and at worst almost intolerable. Transmission of sound from one point to another is affected by the climatic variables (wind, temperature, and humidity) as well as by the physical obstacles present. Trees — because of their many leaf-air interspaces — tend to absorb sound rather than reflect it. A review of available literature and our own research results indicate that groups of trees can alleviate some of the noise problems. Field-trial results show an average reduction in noise of 8 decibels per 100 feet of forest land.

*Leonard, R. E., and L. P. Herrington.
1971. **Noise abatement in a pine plantation.** USDA Forest Serv. Res. Note NE-140. 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Observations on sound propagation were made in two red pine plantations. Measurements were taken of attenuation of prerecorded frequencies at various distances from the sound source. Sound absorption was strongly dependent on frequencies. Peak absorption was at 500 Hz.

*Lull, Howard W.
1971. **Effects of trees and forests on water relations.** *In* **Trees and forests in an urbanizing environment.** Univ. Mass. Coop. Ext. Serv. Planning and Resource Develop. Ser. 17: 65-69.

Clearcutting can substantially increase water yield at a reasonable cost. Logging need not greatly affect storm runoff or sedimentation. Converting a forest to an urban environment can greatly increase water yield, storm runoff, and sedimentation.

Northeastern Forest Experiment Station.
1971. **Pinchot: the man, the house, the legacy.** USDA Forest Serv. NE. Forest Exp. Sta., 8 pp., illus. Upper Darby, Pa.

A brochure describing the establishment of the Pinchot Institute for Environmental Forestry Research in 1970, with a brief biographical sketch of Gifford Pinchot (1865-1946) and his estate Grey Towers, near Milford, Pa., which has been preserved as a museum and as headquarters for the Institute.

Payne, Brian R., and Jack Ward Thomas.
1971. **New developments in environmental forestry research.** Tree Wardens, Arborists and Utilities Conf. Proc.: 27-31. Univ. Mass., Amherst.

The Pinchot Institute for Environmental Forestry Research has been established by the Forest Service to find ways of using trees and forest land to improve the human environment in the densely populated Northeast. A multidisciplinary research team at Amherst, Massachusetts, will study problems in decision-making methods, landscape management, genetic improvement of forest trees, wildlife management, and outdoor recreation. Forest Service researchers at Princeton, New Jersey, will investigate municipal watershed management and the production of amenities by forest trees.

Shafer, Elwood L., and Warren T. Doolittle.
1971. **The Pinchot Institute: "Breaking new ground" throughout megalopolis.** Soc. Amer. Forest., 16 pp.

In establishing the Pinchot Institute, the Forest Service has joined with nine northeastern universities and research institutions to form a consortium for environmental forestry studies. This consortium is organized to develop the information and technology needed to solve problems of policy formulation, regional planning, and land management related to environmental forestry in and around northeastern population centers. The Institute has two research projects located at Amherst, Mass., and Pennington, N. J.

Zube, Ervin H., Hugh C. Davis,
and Robert O. Brush.
1971. **Landscape architectural research in environmental forestry: a research program for the northeastern United States.** 18 pp., illus. Amer. Soc. Landscape Architect. Found., McLean, Va.

A problem analysis prepared by the Pinchot Institute of Environmental Forestry, a cooperative effort by the USDA Forest Service and nine universities (Connecticut, Cornell, Massachusetts, New Hampshire, Pennsylvania State, Princeton, Rutgers, Syracuse, and Yale) to focus research effort on environmental problems of the forest-city interface.

WILDLIFE HABITAT

Bond, Robert S., and James C. Whittaker.
1971. **Hunter-fisherman characteristics: factors in wildlife management and policy decisions.** USDA Forest Serv. NE. Forest Exp. Sta. Recreation Symp. Proc.: 128-134.

Research on the characteristics and motivations of hunters and fishermen is examined for factors important to resource managers and policy-makers. Characteristics related to the learning experience, time for participation, utilization and accessibility of the resource base, and the type of fish and game harvested are considered. Motivational research, although in its infancy, suggests that participation in these sport activities has importance other than for only the taking of fish or game.

*Healy, William M.
1971. **Forage preferences of tame deer in a northwest Pennsylvania clear-cutting.** J. Wildlife Manage. 35: 717-723.

Three tame white-tailed deer were observed foraging in a 17-acre clearcutting during all seasons of 1 year. Deer preferred green leaves to twigs. Blackberry was the most-used food plant year-around. Trees and shrubs were most heavily browsed in winter. Foraging by deer did not appear to be preventing tree regeneration, but such clearcuttings should be at least 17 acres in area to avoid a food-patch effect.

*Jordan, James S.
1971. **Yield from an intensively hunted population of eastern fox squirrels.** USDA Forest Serv. Res. Pap. NE-186. 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Sixty hunting trips (141 hours) to a 68-acre oak-hickory woods in west-central Illinois produced a harvest of 139 fox squirrels (*Sciurus niger*), an average yield of 2.0 squirrels per acre. Squirrels were hunted on 37 days of a 61-day open season. Juvenile squirrels constituted 72.5 percent of the total bag, adult females 14.5 percent. Eighty-five percent of adult females bagged were lactating. The estimated populations at the beginning and the end of the hunting season were 240 and 96 squirrels, respectively, indicating a 57.9 percent rate of exploitation of the prehunt population.

*Jordan, James S.
1971. **Dispersal period in a population of eastern fox squirrels (*Sciurus niger*).** USDA Forest Serv. Res. Pap. NE-216. 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.
Rates of return from August to November among fox squirrels marked from January to May suggested that the main dispersal movement occurred earlier in the year than previously reported for this species — sometime between late May and late July. Dispersal was greatest among juvenile squirrels, somewhat less among subadults, and least among adults; and it was proportionately greater among females — especially juvenile females.

*Knierim, Philip G., Kenneth L. Carvell, and John D. Gill.
1971. **Browse in thinned oak and cove hardwood stands.** J. Wildlife Manage. 35(1): 163-168.

Thinnings stimulated production of both seedling- and sprout-origin browse in mixed oak and cove hardwood stands. When seedling-origin browse is desired, the mixed oak type should be maintained in a high basal area condition (about 100 square feet per acre). The cove hardwood type requires a lower basal area (90-94 square feet). To stimulate sprout-origin browse in both cover types, a lower basal area should be maintained. In this study the low basal-area class for the mixed oak type was 68-76 square feet per acre, and for the cove hardwood type 90-94 square feet.

Marburger, R. G., R. M. Robinson, Jack Ward Thomas, and K. A. Clark.
1970. **Management implications of disease of big game animals in Texas.** SE. Assoc. Game and Fish Comm. Annu. Conf. Proc. 24: 46-50.

Blue tongue, relatively common in domestic sheep, is lethal to bighorn sheep, so they must be managed on extensive ranges free of domestic sheep. Though Theileriasis is widespread and usually does not affect healthy white-tailed deer, malnourished deer are susceptible; so overpopulation must be prevented. Salmonellosis causes fawn losses in some white-tailed herds.

Pack, James C., H. Reed Sanderson, and Robert W. Donohoe.
1971. **Comparison of gray squirrel census techniques.** NE. Fish and Wildlife Conf. Proc.: 145-158.

For measuring year-to-year changes in gray squirrel abundance on a large area, the best of several measures was hunters' success determined from hunter interviews. The other measures — hunter sightings of squirrels, leaf nest counts, squirrel activity count, and mark/recapture indices — were more expensive or less consistent.

*Shaw, Samuel P.
1971. **Wildlife and oak management.** USDA Forest Serv. NE. Forest Exp. Sta. Oak Symp. Proc.: 84-89, illus. Upper Darby, Pa.

General habitat values of the upland oak type are discussed. Major attention is focused on a management scheme to produce sufficient acorns for game and nongame species of acorn-consuming wildlife at optimum population levels. An estimated minimum average of 100 pounds per acre of sound fresh acorns should be produced from the tree crowns to accomplish this goal. A cutting system for an 800-acre management unit is described, based on even-aged silviculture, a 10-year cutting schedule, and an 80-year rotation. Periodic thinning in oak stands is necessary to produce the quantity of acorns required by wildlife.

Thomas, Jack Ward, and R. G. Marburger.
1971. **Quantity vs. quality.** Part 1. Symptoms of deer herd overpopulation. Texas Parks and Wildlife 24(9): 16-19.

Symptoms are deteriorating habitat, reduced reproductive rates, decline in deer-trophy quality, decline in size and weight, and deer die-offs. Consequences are habitat damage, competition with domestic stock, lowered allowable harvest, reduced recreation opportunity, and economic loss.

Thomas, Jack Ward, and R. G. Marburger.
1971. **Quantity vs. quality.** Part 2. A deer management decision. Texas Parks and Wildlife 24(1): 6-9.

Reviews the history of deer management in Texas from near extirpation in 1900-10, through recovery during 1911-55, to the present situation of widely and densely populated ranges within the State. In the process, deer quantity was given emphasis over deer quality. Continued overpopulation of deer has resulted in declining deer quality and deteriorating deer range. A decision is called for: "Deer quantity or deer quality — we can't have it both ways."

FORESTRY ENGINEERING

Biller, Cleveland J.
1971. **Are your log skidder tires too small and underinflated?** Forest Ind. 98(13): 34-37, illus.

The undersize and underinflated tire is one of the costliest problems in Appalachian logging. A method has been developed that the logger can use to determine the correct tire size and inflation pressure for his particular skidder.

*Biller, Cleveland J.
1971. **Prediction of skidder tire wear in Appalachia.** Amer. Soc. Agr. Eng. Trans. 14(2): 350-352, illus.

Research was conducted to identify and evaluate the factors having a significant effect on skidder tire wear and to produce a prediction equation for estimating tire wear on wheeled skidders, based on production levels. These estimates of tire wear can be transferred directly into a more accurate production cost. Variables considered were: inches of tire wear per thousand board feet, working days, weight to power ratios, skid road slope, tire width, tire diameter, and interactions of these variables.

Bolinger, J. W., K. C. Elliott, and A. D. Longhouse.
1971. **Monitoring cyclic power demands of a diesel engine.** W. Va. Univ. Agr. Exp. Sta. 54 pp.

A method of measuring instantaneous power developed by a diesel engine was analyzed and tested, using a tachometer-generator and thermocouples. The portable instrumentation responded within 3 seconds of a power change on a test engine. Calibration must be run for each engine used. Response and accuracy is acceptable for determining horsepower usage of logging equipment where power-use cycles may be erratic.

Gibson, Harry G., and Cleveland J. Biller.
1971. **Side-slope stability of logging tractors and forwarders.** Amer. Soc. Agr. Eng. Pap. 71-611. 19 p., illus.

Articulated-frame, four-wheel-drive, rubber-tired logging tractors and forwarders were analyzed with a mathematical model for determining side-hill stability. A simulation method was used to translate tipping conditions into equations, and a computer program was developed for predicting static tipping angles.

Gibson, H. G., K. C. Elliott, and S. P. E. Persson. 1971. **Side slope stability of articulated-frame logging tractors.** J. Terramechanics 8(2): 65-79, illus.

A technical discussion of the geometry of logging vehicles in relation to stability on a slope. Steering angle, slope, tipping angle, and stability are discussed; and methods are presented for using center of gravity, wheelbase, track, range of steering angle, and slope to compute tipping angle.

Hartman, Robert L., and Harry G. Gibson. 1971. **Techniques for the wheeled-skidder operator.** S. Lumberman 222 (2760): 89, 90, 92, 94, 96-98, illus.

Operating techniques for wheeled-skidder operator trainees are listed and discussed. Subjects covered are bunching logs, load selection, traveling loaded, traveling empty, blade use, and maintenance.

Phillips, Ross A., and Cleveland J. Biller. 1971. **A meter/recorder to measure logging road roughness—progress report.** USDA Forest Serv. Eng. Tech. Inform. Syst. Field Notes 3 (9): 8-10.

An instrument using a gyroscope was developed to measure road roughness, and is now undergoing tests. In addition to use in research, the instrument may be used to determine if forest roads need maintenance, to establish a standard for maintenance, to measure bump severity, and to indicate the amount of attention required by the road.

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